FLIGHT and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH

Chief Photographer
JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

8-10, CORPORATION ST., COVENTRY. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.
GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).
260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.
26B, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1692 Vol. XXXIX. MAY 29th, 1941. Thursdays, One Shilling.

# The Outlook

## Atlantis

IT seems rather strange that, with all the ferrying going on across the Atlantic, there should have been no revival of the old "floating islands" schemes, such as the Armstrong seadrome. A contributor this week recalls Mr. Pemberton-Billing's suggestion that armed ships should be anchored every 100 miles, so that no aircraft being flown across would ever be more than 50 miles from the possibility of rescue.

The anchoring of vessels might present important technical difficulties, due to the great depth of the sea. Mr. Armstrong evolved a scheme which "worked on paper," but, so far as we recollect, it was never tried-out practically, although models of his seadrome were moored out and a full-size working section tested. But in any case, a vessel anchored in a fixed and known position would be a rather tempting bait for enemy sea raiders, and it is to be presumed that the aircraft being ferried across would not, in most cases, be able to carry any great quantity of anti-submarine bombs.

We still think that our recent suggestion of using the towed apron from moving vessels, such as used by the Lufthansa in the experimental work done before the war, might be a better solution, even when used only for rescue work and not, as we suggested, for launching and refuelling anti-submarine patrol aircraft.

Mr. Tennant's article in this issue is, however, of interest in the examination it devotes to the possibilities of giving all American types, even single-engined fighters, the range necessary for the direct flight from Newfoundland. In this connection the Mayo Composite scheme should not be forgotten. Its detail application might be slightly different from that originally employed on the Short-Mayo. It would not, perhaps, be so much a question of getting a heavily loaded aircraft into the air as of carrying the fighters and other short-range types on their way, releasing them when their range, slightly increased by fairly small extra tanks, was ample to get them across under their own power.

Some form of security patrol by surface craft would still be necessary, but the twin-engined types would be less likely to get into trouble.

## Crete

ONE of the strangest episodes of the war is being unrolled as these lines are written. The outcome of the battle of Crete is still in the balance, and details of it have so far been few and rather confused, as is inevitable in view of the wide-scale nature of the action. Outstanding is the extensive employment by the enemy of air-borne troops, transported in aeroplanes and gliders, and landed in them or dropped by parachute.

The geography of Crete rather demands the use of gliders and parachutes in that there are no first-class aerodromes, and only two or three areas sufficiently large and flat to be used as aerodromes—of sorts. They were not considered good enough to be used by our defensive fighters, and so the Prime Minister had to admit to the House that all our fighters had been withdrawn.

It is rather sad to reflect that, although we had sufficient aircraft there, the distance from Egypt is too great to enable our single-engined fighters to operate from there. They would just about have sufficient range to make the flight to Crete and back, well throttled down, but they would have no fuel to spare for fighting. Some of our newer twin-engined fighters, one would suppose, would have been particularly effective in this region, and their inferred absence from Egypt is regret-

table. The Beaufighter, for example, with its heavy armament and considerable range, should have been able to interfere effectively with the landing.

Aircraft carriers as a means of getting our short-range aircraft into the battle seem an obvious solution, but it must be remembered that in narrow waters, such as those around Crete, these vessels are vulnerable to air attack, and in any case, the Navy's need of them is great in getting aircraft of the Fleet Air Arm to the scene of attempts at invasion by sea.

## *Not a Dress Rehearsal*

THERE has been a tendency in certain quarters to regard the Crete invasion as a dress rehearsal which might teach us valuable lessons if Hitler should decide to attempt the invasion of England. It would be well not to assume too much in that direction. The invasion of England would be a very different problem. Not only would the scale have to be stepped up in about the same proportion as the Crete attack was scaled up in comparison with the invasion of Holland, but we should have our fighters.

That is not to say that no lessons are to be learned from the battle of Crete. There are many aspects of it which would be repeated, or closely so, in such an attack on the British Isles. The main procedure would probably be much the same: heavy dive-bomber attacks followed by parachute troops to occupy certain points, glider troops to reinforce them and, finally, troops in aircraft landed on any aerodrome or suitable field held temporarily by the first arrivals. It is conceivable, too, that any attempted German invasion of this country would be scattered and may extend deep into the country. Crete will at any rate have revealed the German tactics and equipment employed so that the element of surprise will not be so pronounced.

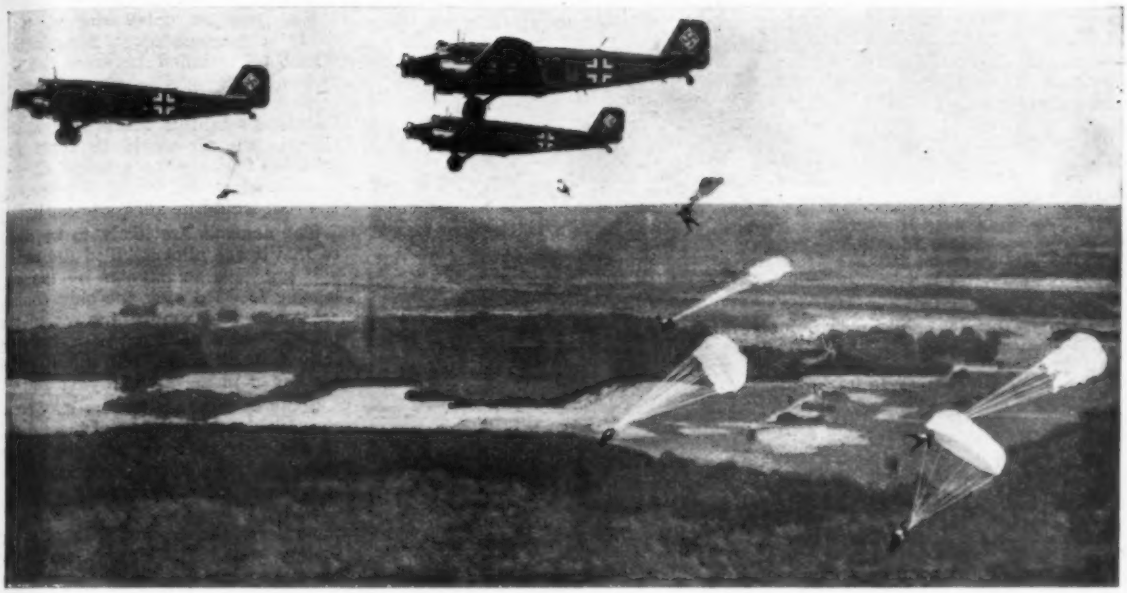
## *Marine Aircraft*

IN one of his articles in *Flight*, on Air Strategy, Captain Norman Macmillan lamented the neglect of marine aircraft. It does appear that the possession of a number of high-performance floatplanes just now might have been extremely useful. There must be a number of sheltered bays in that part of the Mediterranean where floatplanes could be refuelled from ships, and although the floats would detract from performance, the seaplanes would probably have been fast enough to have a good chance of causing severe havoc among troop-carrying planes and gliders. A Hurricane on floats, for example, should be capable of about 300 m.p.h. This would not be a match for the faster German fighters, but although the weight would be increased and the normal range reduced thereby, the compromise would be worth while.

Damage done by our aircraft to the German air invaders seems to have been considerable both in raids on Greece and over Crete. Our gunners in the bombers have ceaselessly attacked the enemy in and over Crete, but the function of the bomber's guns is defence rather than attack.

One interesting aspect, mentioned by a special correspondent of the *Times*, is the use by the enemy of seaplane gliders at Crete. For several years the Germans have experimented with small gliders of this type, and in the main it has probably been just a matter of "stepping-up" the size. The original idea was to start the gliders from the water by towing them off with a fast motor boat. In Crete, however, it appears that the gliders were towed to the scene by aircraft, and they were merely required to make a coastal landing under their own power, and not to take off again. That would mean that stepless hulls could be used, with consequent saving in drag. It would be reassuring to know that the seaplane glider is not being neglected in this country.

**PERAMBULATING AERODROME: The flight deck of one of our aircraft carriers with Fairey Fulmars and Blackburn Skuas ready to take off.**



With the quick-opening Eschner parachute, broken out by static line attached to the troop carrier, paratroops can jump from as low an altitude as 200ft. though more usually the descent is made from 500ft. In this photograph German troops have just left a formation of Junkers Ju 52s.

# TROOPS BY AIR

## *Troop-carrying Trailers in Crete : Probable Towing Methods : Trailer Design*

By BRUCE FOSTER, B.C.E., D.I.C., A.F.R.Ae.S.

CRETE is most valuable experience for the British arms. The Germans have used a weapon, the existence of which we have long been aware of, and for which we are prepared in this island. But now their method of using it can no longer be a secret from us (if it ever was) for it has been used against British troops for the first time in Crete. This is the troop-carrying glider, or to give it a better name, the air trailer.

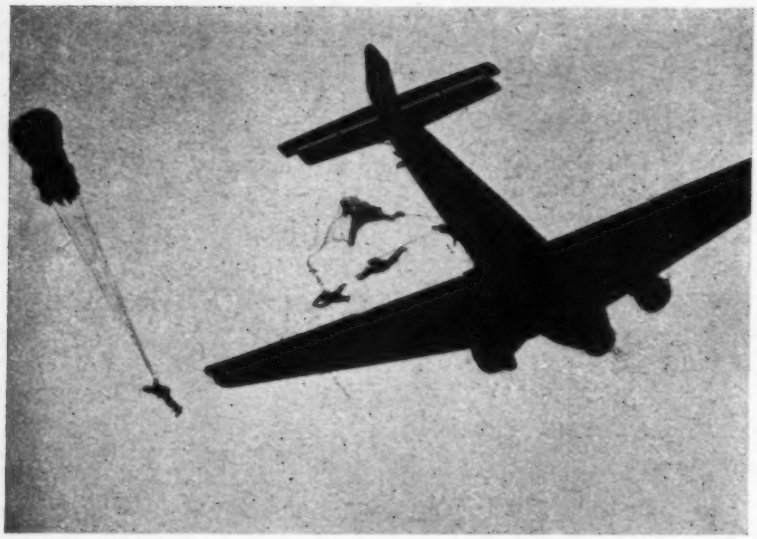
As long ago as last July an article was published in *Flight* on this subject and the opinion advanced that although air trailers were vulnerable to attack by fighters, they had several advantages which would make them worth using to carry some, but only some, of the troops needed in an invasion attempt. These advantages were: their power to increase the carrying capacity of the enemy's troop transports by a small sacrifice of the speed; their silent arrival, perhaps in darkness or just at dawn, after being cast off at about 10,000ft. ten or fifteen miles before reaching the coast; their ability to land at very low speed, 35 to 40 m.p.h., in very small fields. All these are advantages which the air trailer possesses as a troop transport. Like the use of the parachute in war, the use of the air trailer was received sceptically in some quarters because one could think of many situations in which it would be of very little use. To land any considerable number of troops successfully by glider was held by many people to be impossible while the Royal Air Force flew in the British sky. But war is a human activity in which the impossible is frequently made possible, thereby staggering the imagination of the generals.

Other ways in which air-borne troops arrive are by parachute and by transport aircraft. Both these ways are familiar to us—though not because any have landed in England! But all three methods have been used in Crete, and the experience which our forces have had in dealing with this army descended from the air is invaluable. We knew previously about the parachute—it is the quick-opening Eschner variety—and the troop transport—the Junkers Ju 52 three-engined all-metal airliner. From now on we shall know all about the air trailer too.

In the article last July it was calculated that a trailer carrying 10 troops and their equipment (250lb. each) could be towed behind a Junkers 52 and would reduce its speed from 140 to 120 m.p.h. The empty weight of the trailer was suggested at 1,700lb., and its loaded weight 4,200lb.

From certain information which we now have it seems likely that the German trailers are somewhat larger than this, probably 15 passenger models, weighing empty 2,500lb. and loaded 6,300lb. They will certainly be high-wing monoplanes to give the wing the necessary ground clearance in the take-off, and their span would be 70 to 75ft. Structurally of wooden construction, the wing and fuselage covering might be either fabric or plywood. Though the wings and tail unit would probably have square tips and straight tapers to simplify production, the aerodynamic design of the trailer would be sufficiently refined to keep drag down, or the towing load would be excessive.

That brings us to the interesting point about how many would comprise the train and how they would be hitched on to the aerial tug. This might perhaps be a separate cable for each trailer, in which case probably three would be the maximum number to each towing aeroplane. Using different lengths of cable and flying at different heights, the possibilities of fouling would be reduced to less than many other war risks. The middle trailer would stay exactly behind the tower, and the other two, by means of a small amount of rudder held on all the time by spring or a trimming tab, would fly at each side. The obliquity of the cables for the outboard gliders could be reduced by attaching them to the wings at about the engine nacelles.



**It is essential that paratroops jump with very little time interval between them so that they are not scattered when they land. The static lines will be noticed.**

Three 20-seater trailers attached to a Ju 52 would be a big load for that not very powerfully engined craft, and its speed would be reduced drastically. Instead of 140 m.p.h. it might only be able to achieve 90 and its rate of climb and ceiling would be startlingly low. In view of this a pair of trailers is more likely than three, unless the Germans have equipped the towing Ju 52s with more powerful engines and constant speed or variable pitch airscrews, or, indeed, used some of their four-engined aircraft with more than three.

Another method of towing is in line astern by a single cable. There is an objection to this system in the long length of runway required, for the train would have to start the take-off run all connected together and with the wire cables between them taut. If the cables are attached to the nose and tail of each glider, control in the air may be difficult, for the attitude of each depends to some extent on the relative angles of the nose and tail cables. If one trailer got too low, the tail of the one in front of it might be pulled down into such an attitude that it would stall. But this trouble might be avoided to a great extent by the attachment of both cables to the underside of the fuselage near the centre of gravity. Such an arrangement, instead of the nose-tail system, does not exactly simplify the take-off, for a rear trailer getting a little too high might easily foul with the cable the tail controls of the one ahead.

News from Crete at the time these notes were written is too confused to be relied upon. One statement describes "line formation" method of towing with "about 10 to each aeroplane," four-engined aircraft being used. There are also seaplane gliders with auxiliary power to propel them to the shore. Later reports speak of "a mixed collection of gliders," some small (6 or 8 men), and others with 14 men, one aeroplane towing two or three gliders. But this is contradicted by the description of Ju 52s towing six gliders each, with perhaps 12 men to each glider. While the battle rages, a battle the like of which the world has never before seen, we cannot expect reports any more accurate than these. But soon we shall know.

Reverting to detail design, it is likely that telephonic communication would be installed between the tug and all the gliders through wires carried along the towing cables. Windows would be unnecessary as the time in the air would be short and windows increase the amount of constructional work. Small skylights in the roof would be adequate for light.

The controls are likely to be dual, so that if one pilot is killed the trailer will not dive to disaster by his collapsing forward over the only control column. And that brings us to the pilots. These need not necessarily be fully trained pilots, but infantrymen instructed in the art of flying gliders.

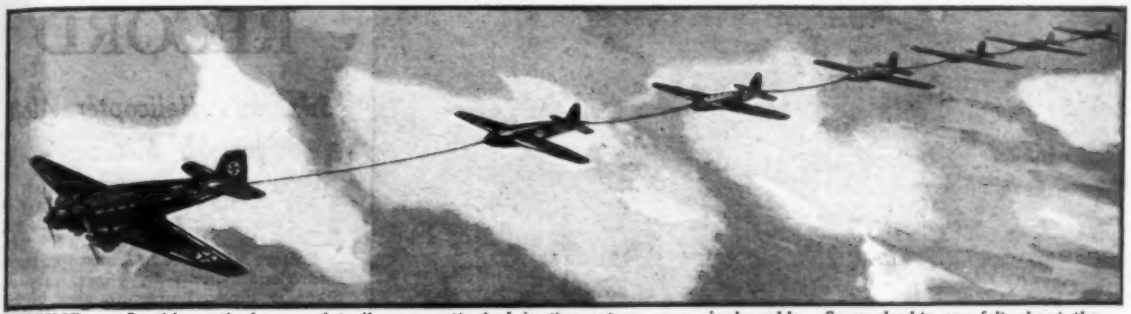
Some of these air trailers may cross the British coastline one of these days. If the fighters have not dealt with them and their aerial thug-containing tugs soon after, perhaps the Home Guard will have a chance to shoot at them from the ground with rifles or tommy guns. The Home Guard may be disappointed with the results, for they are unlikely to be spectacular. There will be no trailers shot down in flames, nor will they explode, and only a lucky shot through the control cables will put them out of control so that they crash. They have no engines and no petrol tanks—hence no spectacular accidents even if they are riddled with bullets. They will almost always continue their imperturbable and silent glide to the ground.

The devil you know is less frightening than the devil you don't know, and this applies to Nazi war devices. So, should air trailers appear in the English sky, their characteristics will be known and they will be dealt with effectively. One characteristic of their design appears to be the result of considerable foresight—they were not designed for a return flight.

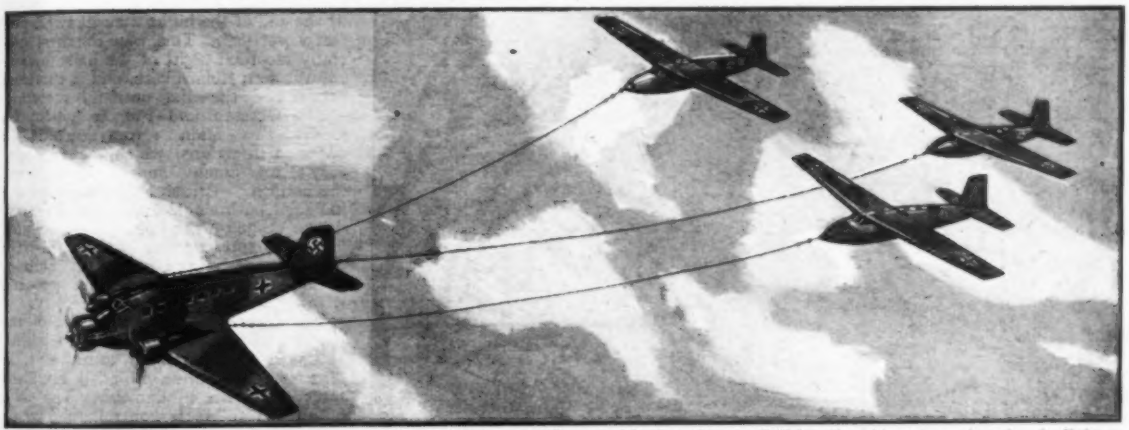
They do not need to be.

**For infantry with more elaborate equipment, the Junkers Ju 52 troop transport is used. Such equipment comprises bicycles, machine guns and small field guns.**

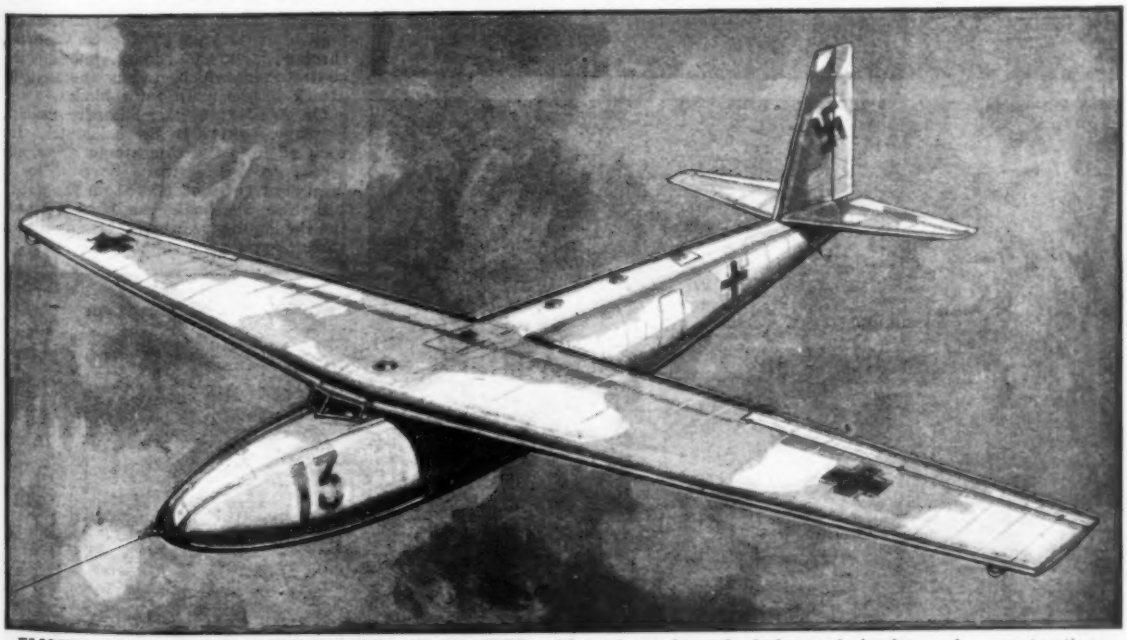
# TOWING AIR TRAILERS



METHOD 1. In this method, several trailers are attached in line astern on a single cable. Some doubts are felt about the feasibility of this system for any more than a few, on account of take-off and control difficulties.



METHOD 2. With each trailer on its own cable and flying at different altitudes, the possibilities of accident are reduced. A slight amount of rudder bias would be needed to hold the two outer trailers in correct formation.




*FLIGHT'S* IDEA OF A FIFTEEN-SEATER AIR TRAILER. Of good aerodynamic design and simple wooden construction, the trailer has a cargo space in the nose. Windows are dispensed with, there being merely small lighting holes in the cabin roof. An emergency exit will also be noticed and a gun station in the rear to allow the use of one of the infantry machine guns carried by the troops.

# HOVERING RECORD

## *Sikorsky's Helicopter Aloft for 65 Minutes*

LAST month, with Igor I. Sikorsky at the controls, a record-making flight of the Vought-Sikorsky Helicopter VS-300-A took place at Stratford, Conn. For 1 hr. 5 min. 14.5 sec. Sikorsky hovered over an area of less than an acre, after having made a true vertical take-off with no ground run or angular climb. The descent and landing at the end of the flight were likewise perfectly vertical. This was the first officially recorded flight of the helicopter in the Western Hemisphere, and it therefore established the first national record.

The German and French helicopters utilise two main rotors turning in opposite directions, which makes necessary a much more complicated mechanism. British experiments have included both single and twin rotors.

The VS-300-A can operate from an area less than 50ft. square, but should have 20ft. or 30ft. more for error in piloting. It is a single-phase machine powered with a 90 h.p. Franklin engine.

The gross weight at the time of the record flight was approximately 1,290 lb. It has a 3-bladed main rotor, 28ft. in diameter, and three 2-bladed auxiliary tail rotors, 92in. in diameter. The pitch of all the rotors is controllable, which provides control in flight. The power is transmitted in the experimental model through a multiple-belt drive for purposes of flexibility in making alterations. Control is secured by the conventional throttle, stick and rudder, plus a pitch control lever which governs the angle of attack of the main rotor blades.

On April 17th Mr. Sikorsky made a seaplane flight with the helicopter. He took off from the Housatonic River, adjacent to the factory, hovered for a minute or two and landed on the water. Flotation was made possible by removing the landing gear and replacing it with three cigar-shaped rubber floats.

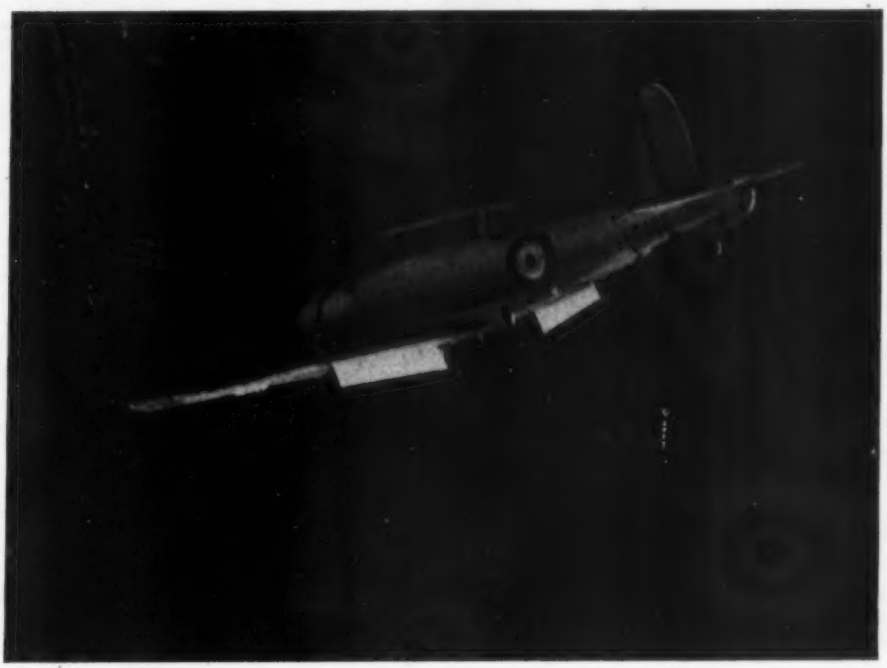
# THE PLACE OF THE DIVE-BOMBER

## *Functions of the New Weapon in Modern Warfare*

By MAJOR F. A. de V. ROBERTSON, V.D.

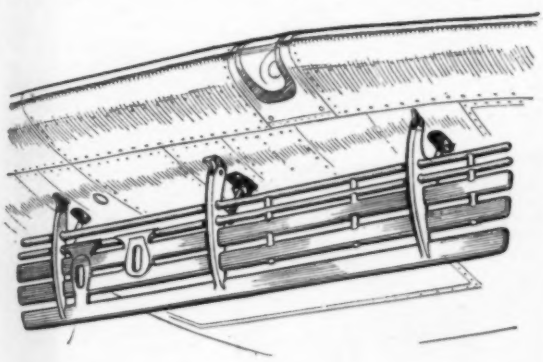
IT has been announced that the American Vultee Vengeance is being developed as a dive-bomber for use by the Royal Air Force. The Vengeance is a variant of the Vultee Vanguard, a single-seater fighter armed with ten machine guns, one of the main differences being that the Vengeance is driven by an Allison liquid-cooled engine in place of the air-cooled engine in the Vanguard. With this motor it is believed that its top speed will be getting on for 400 m.p.h.

The German campaign in Poland first brought the dive-bomber into prominence as a weapon for use with an army. Before that it had been regarded chiefly as a naval weapon. The first type of this class on record was the Curtiss Helldiver which was produced for the U.S. Naval Air Service. The idea attracted attention in Britain, and some squadrons of Hart light bombers were chosen to work out the technique and tactics of dive-bombing. The idea was to use the manœuvre against enemy warships. In those days there was a pretty general ambition, at least among the junior commissioned ranks of the R.A.F., to prove that fleets had been made obsolete by aircraft, and to persuade the Government to stop building battleships, diverting the sums saved to the purchase of thousands of Harts. R.A.F. men professed to believe that bombs dropped from an altitude would drive navies off or under the seas. Certainly in practices against wireless-controlled ships the bombs did not always score hits; but then the devotees of the bomb fell back on the case of the German battleship *Ostfriesland* which was holed and sunk by the U.S. Army Air Service by means of a near miss.



**NAVY OVER THE LAND : A Blackburn Skua dive-bomber of the Fleet Air Arm attacking at an angle of about 70 degrees. The diving brakes are at right angles to the under surface of the wing.**

But if precision bombing was not altogether reliable, the invention of dive-bombing, it was urged, would certainly secure bull's-eyes. The bombs which a Hart could drop were certainly not heavy enough to sink a ship with deck armour, but they would account for lighter craft and merchantmen. At any rate, the principle of dive-bombing had been established, and it was only necessary to develop it.



**T.V. LIMITER : All dive-bombers built on the modern monoplane specification require air brakes to limit their terminal velocity. The sketch shows the Junkers Ju 88 air brake.**

### Ground Strafing

The Germans developed it, and used the dive-bomber as a weapon of their Army rather than as one to be used by or against warships. This development showed brains, and to those brains were largely due the conquests of Poland and France, and perhaps of the smaller countries as well.

The use of aircraft to attack ground troops has not been neglected in Britain. In the latter years of the last war "ground-strafing" was a regular thing, but it was a job always entrusted to the fighters. In opposing the great German advance in March, 1918, the R.A.F. fighter squadrons lost heavily while flying low to machine-gun the German troops. About that time the Sopwith Salamander was produced as a "trench-strafer," and the pilot's seat was armoured to protect him against small-arms fire from the ground. The idea was not so much diving as flying low above the line of trenches.

Gradually, however, it was realised that the machine gun

**HELL DIVERS : Two Curtiss S.B.C-4's in formation. A number of these biplanes have been sent to Britain. There is provision for carrying either a 500 lb. or 1,100 lb. bomb under the fuselage and a further 100 lb. missile under each wing. In the photograph above, long-range petrol tanks take the place of the main bombs.**

was not the best weapon to use when attacking ground troops from the air. Plunging fire cannot be so effective as grazing fire, and in any case small bombs will injure more infantrymen than bullets fired from a rapidly moving platform can do. The use of bombs implied some form of dive, and this was practised—still by the fighter squadrons. Many of our readers will remember early Hendon displays at which a fighter squadron would form a circle over the target, and each pilot would dive on it in turn and drop a light bomb. As he climbed up to rejoin the merry ring above, and so became vulnerable to fire from the ground, another pilot would dive on the imaginary machine-gunners down below. Working out the sequence of the dives must have been an intricate business, and no mere onlooker could guess which of the circling machines would next put its nose down. The first exhibition of this sort, about the year 1925, was (if memory serves) given by

## THE PLACE OF

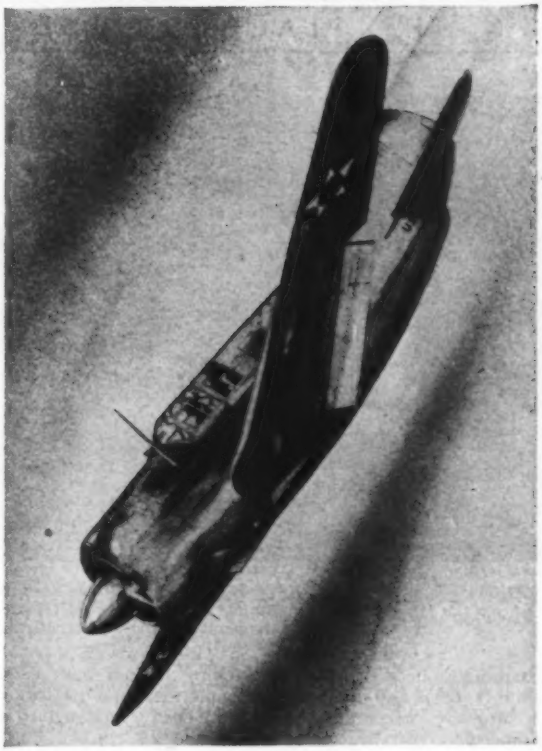
No. 25 (Fighter) Squadron under Sqn. Ldr. A. H. Peck, flying Gloster Grebes. Another very excellent show of the same description was given a few years later by a Fleet Fighter Squadron in Fairey Flycatchers. In the big Army manœuvres round Andover in 1925 these tactics were used by Nos. 25 and 56 (Fighter) Squadrons.

The bomb was certainly the right weapon for attacking ground targets, but there were faults in the tactics adopted. Fighters were probably the only class of aircraft at that time which were agile enough to form that spectacular ring above the infantry, but it was wrong to use fighters for the purpose. It had been wrong to use them for ground-strafing in 1918, for fighters are always urgently needed for their own proper duty of keeping the skies clear of enemy aircraft. Moreover, the light bombs which they carried, though they would have been very effective against infantry in column of route, would have been of little avail against pill-boxes or other strong positions. The use of aircraft against ground troops is a special business, and requires special study, special training and special equipment. At a fairly early stage this was realised by the U.S. Army Flying Service which developed its Attack branch for this purpose. Its Attack machines are not to be confused with its Pursuit machines—the latter being what we call fighters.

But, as we all know now, it was the Germans who gave thorough attention to the matter and designed the Ju 87 as a dive-bomber for use against positions which were holding up the advance of their ground troops. It is typical of the German liking for specialisation that the Ju 87 is of no use for anything except the one task of dive-bombing. It is slow and clumsy, badly armed, and incapable of either holding its own against a fighter or escaping from it. But it can dive steeply, and it drops bombs of very useful destructive power. Where there is little or no air opposition, as in Poland, it can range ahead of the armies and put aircraft factories, aerodromes and headquarters out of action. Its most important function is to help the ground troops, and particularly the mechanised armoured forces, when they are held up by entrenched positions. Whenever that happened in recent campaigns, the tanks would signal back to Corps H.Q. asking for aircraft support. Up would come the dive-bombers and hurl their loads down on to the obstruction. Sometimes the bombs would destroy it; more often the moral effect

**NEW DISORDER CREATOR : The Junkers Ju 87 (Stuka) dive-bomber which has featured so prominently in German military operations. Its maximum diving speed without brakes is 430 m.p.h., this is limited to 248 m.p.h. with the air brakes in operation.**

## E-BOMBER (Continued)



**FOR THE U.S. NAVY : An artist's impression of the Curtiss X.S.B.C-1 (Experimental Scout-Bomber Curtiss) monoplane which, with its 1,700 h.p. Wright Cyclone, represents America's most recent development. No particulars are available.**

of the dive and the explosions would so un-nerve the defenders that they ceased to resist, and then the tanks came on and captured the position.

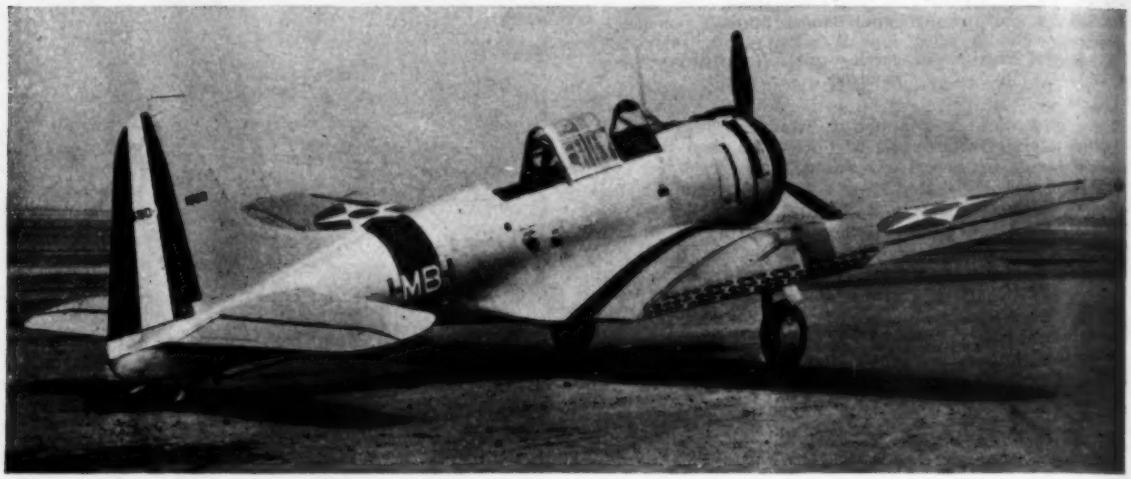
It should be noted that there is a tendency among those who know very little about the air, and also those who do not know much about anything except the air, to assert that mastery in the air was responsible for the speedy German conquests in Poland, France and, more recently, of Greece. That is only partly true. Those triumphs were due to the skilful combination of arms and weapons. In the history of war it is very rare to find one weapon winning a whole campaign. One may instance the Greek fire of the Byzantines, the Parthian cavalry which defeated the Romans under Crassus in a desert battle, the English longbow in the Hundred Years' War, and certain other cases. But, for the most part, novel weapons are best employed when skilfully combined with others in one general well-conceived scheme. The tank is also a novel weapon of great power, but it is more than doubtful whether either tank or aircraft alone would have won the German campaigns without the help of the other.

### Norway and Greece

In Norway the bombers, and mainly dive-bombers, had to work with only limited assistance from tanks in attacking the Allied troops who had landed in the north of the country. They succeeded because the British could not get fighters established on shore, and consequently there was no air opposition. British Army officers who returned from Norway reported that the attack of dive-bombers was very nerve-wracking, but really did very little harm. At the end of the Greek campaign Lieut.-Gen. Sir Thomas Blamey, in an order of the day, remarked to his Australians: "The withdrawal was continually harassed by the enemy air bombing all along the roads. Our losses through all this have been extraordinarily light, and we have learned how very inaccurate aerial bombing is." This bears out the reports from Norway, and tends to show that

**WITH FLYING COLOURS : Air Marshal W. A. Bishop, V.C., R.C.A.F., in front of a Vultee Vanguard which has the R.A.F. roundels. It has been stated that the Vengeance is a dive-bomber variant of the Vanguard.**

# THE PLACE OF THE DIVE-BOMBER (Continued)



**ANOTHER SCOUT-BOMBER :** In the United States the dive-bomber is officially designated a scout-bomber. The illustration shows the Douglas S.B.D.-1 which, with Mks. II and III are in quantity production at Los Angeles. Fretted diving brakes are employed and the bomb is carried externally on an ejector arm. No other particulars are available.

bombing alone will not secure victory, though shortage of aircraft (or of any other major weapon) may be disastrous.

Naturally, when the B.E.F. had been evacuated from France last year, the Army demanded that the Air Force should supply it with dive-bombers, as, though they may not inflict many casualties, they had certainly played a notable part in the German successes. This was one of the subjects discussed by the General Staff and the Air Staff at the time when it was decided to form the Army Co-operation command. Of course, the Army's demand had to be met, but the Air Staff decided not to concentrate on a highly specialised dive-bomber, like the Ju 87, which would be of no practical use when the Army was only standing on guard, as it has been in Great Britain ever since Dunkerque. The idea was preferred of a dual-purpose bomber, which could be used for ordinary bombing work in between times, but was capable of diving steeply when required.

What British designers are doing about this is not for public consumption, but the announcement about the Vengeance is very interesting. That machine will be of the nature of a fighter-dive-bomber. The Navy possesses fighter-dive-bombers in the now obsolescent Skua and Roc two-seaters, but neither of them approaches the speed of the Vengeance. The Fleet Air Arm is often obliged to adopt dual-purpose types because of the limitations of space in a carrier, but such considerations do not apply to an aircraft for Army use. To some extent it appears as if we are going back to the practice of 1918 and will use fighters for attacking ground troops. There are, however, obvious differences between the two cases. In 1918 the fighters were mainly used to delay the advance of attacking infantry and, as mentioned above, their weapon was the machine-gun. In the present war the function of a dive-bomber is to assail defending troops, and its main weapon is the bomb. The speed and the armament of the Vengeance will mean that it will never be so much cold meat to the Messerschmitts, as the Ju 87 has been to the Hurricanes. It is possible, in fact, probable, that squadrons equipped with the Vengeance (and there are other American dive-bombers, to wit, the Curtiss-Wright XSB2C-1) will be kept in two classes, one class for fighting, and the other for dive-bombing. That would avoid the risk of leaving the upper air insufficiently defended while a way is being cleared for the advance of Army troops. It may be assumed that if gallant Poles and Frenchmen were over-awed by the attacks of dive-bombers, German soldiers will be equally impressed.

### Combination of Weapons

In the debate on the war in the House of Commons on May 6 Mr. Hore-Belisha urged that "as much attention ought to be devoted to the production of tanks as of aeroplanes" This ex-Secretary for War has evidently grasped the need for the combination of weapons in a land war. He might perhaps have added that if it is correct, as many authorities believe, that Germany must finally be defeated on land, it is necessary to give as much attention to the production of Army aircraft as of heavy bombers for independent air action. The Germans have always employed dive-bombers in great numbers, and we must be prepared to do the same.

**DIVE OR PRECISION:** The Junkers Ju88 was originally designed as a high speed precision bomber and has been modified for use as a dive-bomber. Maximum speed with air brakes is 340 m.p.h. and 419 m.p.h. without air brakes.

*Topics of the Day*

# POOLING EXPERIENCE

## *First-hand Experience of Enemy Types is Necessary : Rebuilding the Wrecks : Facing Facts*

SOME time ago *Flight* published a leader suggesting that possibly it might be a good thing if we had a pool of test pilots so that each firm would not only have its own pilots' reports but also those of other firms. It is undoubtedly a fact that certain characteristics, not always very desirable, tend to be reborn in each type produced by any particular firm.

I have another and much more difficult idea. Every firm and every operational training unit should have at least one example of the latest type of machine produced by the enemy. Much more easily said than done, of course, but there are quite a few fairly modern German types knocking about and being put, as far as one can see, to no particularly good use. And I don't mean Messerschmitt One-o-Nines. If one can believe the pictures one sees, there is at least one airworthy Junkers 88 and, I believe, a Messerschmitt 110 being looked at and even being flown somewhere.

### Handling Characteristics

It is very nice to have these machines about the place, and to think that certain crack pilots from Farnborough and elsewhere are amusing themselves in them. No doubt the representatives of the different firms are invited to inspect them, and the technical Press is (or are) invited to describe them in detail as soon as they are off the German secret list. In the meantime, we know as much about aircraft design and construction as the Germans do, and the real interest in captured enemy aeroplanes lies in their handling characteristics and not in the beauty of the Elektron castings to be found in the engine or in the (most expensive and quite uneconomical, old chap) methods of construction used in the airframe.

The air war would be more nearly won if we could obtain a flying example of every German type as it came into service. That is impossible, but we can learn a lot from any moderately up-to-date types which are captured, and it would be worth while to spend a lot of time and money in making the moderately crashed types fit to fly again. More worth while than to leave them littered about the countryside for the benefit of the organisers of War Weapons Weeks and the like.

If most of the pupils of every O.T.U. could fly the different bomber and fighter types which are at present in use over this country, or if the instructors at these O.T.U.s could do so, we should certainly be getting somewhere. Even the obsolescent types are of very real interest, because every firm is inclined to produce types with similar characteristics, and knowledgeable people would at least be able to guess at the flying technique to be developed. The German O.T.U.s are undoubtedly equipped with 109s, 110s and the older bomber types, and the pupils will be taught to fly and handle these machines first. It is reasonable to suppose that they will bring their training ideas into action when they fly more modern machines, so we shall not be so very far behind.

### Listen to the Pilots

In this war we seem to be inclined to listen more to the technical people than to the pilots. Admittedly the latter are a temperamental crowd, ready to develop biases about most things, but these biases are more reliable in some cases than the slide-rules of the clever fellows who stay firmly and sometimes unhappily on the ground.

The technical people can produce the most prodigious devices which not only go quickly but which can stay in the air for an indefinite period, yet these are quite useless if the pilots don't like them or are afraid of them. Furthermore, there is a sort of inertia still to be found in the business of aircraft production. If an order has been placed it goes through. The result is that there are quite a fair number of useless pieces of aeronautical ironmongery littering the earth here and there. Things which will now never be used for operational work and probably not even for training.

Inertia is usually thought of as static. In fact, it is at its worst when it is thought of as an irresistible object in motion rather than an immovable object *in situ*. One or two prototypes could decently have been left *in situ*—mistakes are inevitable and we are not the only people to make them—but the results still tend to be poured on the unsuspecting but not so very innocent pilot.

Which reminds me that there has been far too much ballyhoo in this war. We take and like a deal of unpalatable truth, but this is sandwiched between a good measure of pep talk and/or pijaw which infuriates the mythical man in the street—in other words, you and me. Let us have the unpalatable truth without the trimmings. Eventually the M.O.I. will learn that we are not mocked; you can't even fool all the people some of the time, let alone some of the people all the time.

### Talking Sense

It's a bad, unpleasant and difficult war. We shall win it. But only when everybody realises that it *is* a bad and difficult war, and not while all sorts of people are sitting around doing only what they have to do, and while some are not doing anything at all. A specially suave voice from the announcer on the wireless is merely irritating when we know that we have bravely lost part of a city or a couple of countries.

As I have said, we shall win this war because we are determined to win it, but there is no point in continually talking, in parliamentary manner, about things which don't matter. Nor is there any point in pretending that the inhabitants of some of our big industrial and other centres find air raids stimulating things. They don't; they're hell, but the people accept them as part of the price of war. When they hear that the casualties are "not as high as were originally thought when they were thought to be higher than they are thought at present" (or words to that effect) they are not irrationally annoyed.

We start with a distinct advantage. The official Germany does not even admit that anybody much has been killed at all, so the people in Hamburg and Bremen must be quite annoyed when they listen to the radio. When *we* give figures at all they are as correct as they can reasonably be.

Let us try to talk solid sense all the time and to think of things as they are. We can take it. These words are used all the time, but nobody in the M.O.I. seems to take them so very seriously.

"INDICATOR."

---

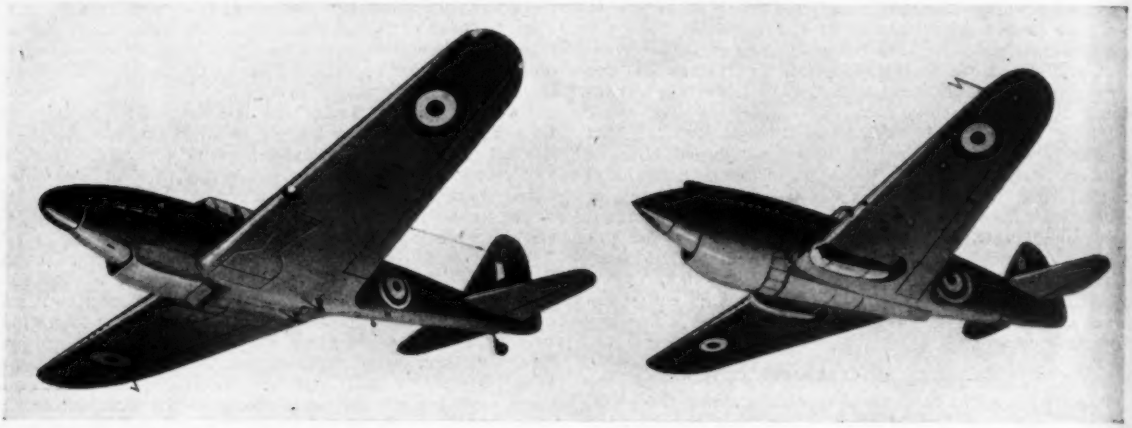
### *An Appeal to You!*

ALTHOUGH the Red Cross Penny-a-Week Fund has 5,000,000 contributing members who provide it with a regular income of nearly £18,000 a week, this only represents something less than 0.1d. per head of the population—not a very generous public response when one learns that, in April last, this splendid organisation overspent itself by no less than £50,000 in sending 400,000 parcels of food, clothing and other much-needed comforts to our men in German prison camps, the total cost being £200,000.

This is YOUR affair, the Red Cross says (and who can deny it!) so if you want to do something about it, the address of the fund's secretary is 89, Kingsway, London, W.C.2.

# FRIEND or FOE?

## *If It's Either of These, You're Safe! The Fulmar and the Tomahawk*

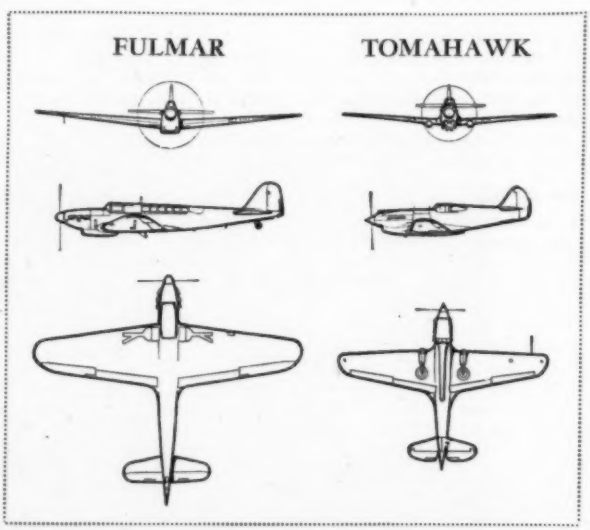


**Fairey Fulmar. Low-wing, moderate taper, rounded tips, dihedral from roots. Large radiator under nose; rounded spinner. Long covered cockpits. Tapered cantilever tailplane; large fin and rudder.**

**Curtiss Tomahawk. Low-wing, moderate taper, rounded tips, dihedral from centre-section, large fillets at roots. Beard radiator; pointed spinner. Tailplane leading-edge tapers; rounded elevators and tips; undercarriage fairings.**

HERE are two more similar-looking machines, either of which will answer the all-important "friend-or-foe" question reassuringly. The Fairey Fulmar, as most readers already know, is a two-seater fighter in service with the Fleet Air Arm, while the Curtiss Tomahawk is one of several very fine American single-seater fighters supplied by our industrious Ally to the R.A.F. The Fulmar is not likely to be encountered very far inland, but the Tomahawk, of course, may be seen anywhere that Fighter Command operates. Actually the Fulmar is some 10ft. wider in wing-span and at least 6ft. greater in overall length than its American cousin, and although this difference in size would be obvious enough were the two machines seen flying side by side at no very great altitude, it would hardly be sufficient to establish the identity of either when observed alone. In plan view the wings of both machines are almost identical in outline, both having a moderate and uniform taper on leading and trailing edges and well rounded tips. The Tomahawk, however, has appreciably larger fillets at the wing-roots and its fuselage is of much greater girth in relation to its length than is that of the Fulmar. There is also a useful difference in their tails, since it is one that will be apparent at any altitude provided that a clear outline can be seen. The Fulmar's tailplane is, in plan, approximately a scaled-down version of its wings, but that of the Tomahawk is a "prettier" design, having a pronounced taper on its leading edge and gracefully rounded tips and elevators, between which projects the pointed tail of the fuselage carrying fin and rudder.

Both aircraft are characterised by the bulge of a radiator beneath the streamlined nose, but that of the Fulmar is set back towards the leading-edge of the wings, whereas the Tomahawk has a true "beard" type radiator immediately beneath its Allison engine. The British machine, incidentally, has a rounded spinner, but the American favours a sharply pointed one, while the top-line of its nose is broken by an air in-take flanked by streamlined "exits" for synchronised guns. These excrescences, however, will only be visible when a really good side view is presented. Such a view, of course, brings into evidence the greatest difference between these two aircraft, namely, the shape and proportions of their respective fuselages and vertical tail surfaces. The Fulmar's pilot sits right above the leading-edge, the "office windows" stretching well back along the straight-topped fuselage to the wireless operator's cockpit amidships. The Tomahawk, however, has a short covered cockpit, the top of which makes a gentle curve down to the base of the fin, and its sole occupant sits above the centre-line of the wings.

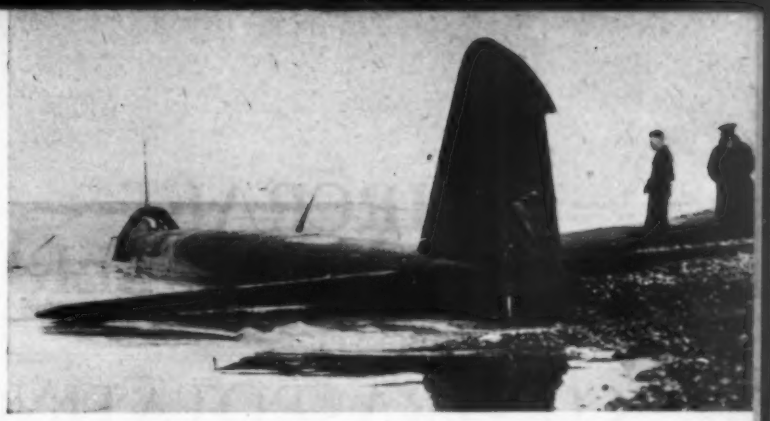



The Fulmar is also distinguishable by its large, low aspect-ratio fin and rudder which slopes back on its leading-edge to a broad, rounded apex and a straight, vertical trailing-edge. That of the Tomahawk has a nicely curved trailing-edge to match the style of its elevators. Both undercarriages retract into the wings, but whereas that of the Fulmar follows the usual British practice of folding its wheels either inwards or outwards (inwards in this case) the legs of the American machine fold *backwards* beneath the wing, the wheels rotating through 90 degrees.

*Next week: Miles Master and North American Harvard (trainers).*

# AS NIGHT FOLLOWS THE DAY

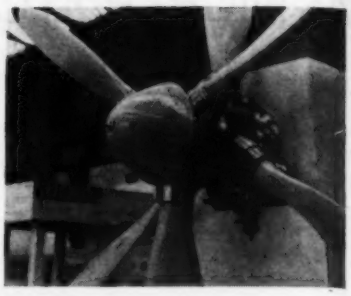
## *Night Victories Approach the Desired Ten per Cent.*



FOLLOWING the success of our Metropolitan fighter force in keeping the skies of Britain more or less clear of raiders during the day, our night fighters, aided and abetted by secret and other devices, have exceeded all previous records. During the first sixteen nights of May no fewer than 142 enemy raiders were certainly accounted for, in addition to a large number known to have been damaged. A sure and certain sign of the growing effectiveness of our night defence is the extravagant claims made by the Germans of the casualties among our night fighters. Actually these are infinitesimal. This page of pictures, showing what is revealed the morning after the night before, is symbolic of what is happening to a lot of German aircraft and air crews. On the night of May 10th the destruction of 33 aircraft represented nearly one in ten of the raiding force.

THE AIRCRAFT ENGINEER

No. 183 16th Year



Contra-rotating, constant speed, fully feathering. This photograph shows the Fairey double-three airscrew.

# CONTRA-ROTATING PROPELLERS

## *Possible Gains in Efficiency*

By J. LOCKWOOD TAYLOR, D.Sc.

AMONG the means of absorbing large brake horsepowers, such as are available from modern engines, on a moderate airscrew diameter without excessive tip speed, is the adoption of twin co-axial propellers, rotating in opposite directions. A plea for their adoption was published in *Flight* recently. Additional advantages accruing from this arrangement are the virtual elimination of torque reaction and slipstream asymmetry (affecting stability and control both on the ground and in the air), and increased efficiency, particularly under certain operating conditions. It is with the latter that the present note is concerned.

Some idea of the gain in efficiency possible through eliminating slipstream rotation may be obtained by approximating to the rotational loss in terms of the usual airscrew performance constants, for an ordinary single-rotating propeller. The standard momentum theory gives for the rotational inflow factor, a′, the value

$$a'x^2 = 4k_q/\pi^2 J\ (1+a).$$

where $x = r/R$ = fraction of screw radius,
$k_q = Q/\rho n^2 D^5$ = torque constant,
$J = v/nD$ = advance constant,
$a$ = axial inflow factor,

in the usual notation. The derivation follows exactly similar lines to that of the well-known expression for axial inflow in terms of thrust. It is necessary to assume a particular torque distribution (linear torque grading), but even if the actual torque grading departs from this, there can be no serious error in applying the formula to the typical section, $x = 0.7$. This gives approximately

$$a' = 0.8k_q/J\ (1+a)$$

as the inflow factor, expressing the induced rotational velocity at the screw disc as a fraction of the speed of rotation relative to still air; a′ is also the fractional loss in efficiency, due to rotation.

Numerical values may be arrived at from any standard series of airscrew performance data giving the thrust and torque constants over a range of advance. Some figures for the N.P.L. family of four-bladers are as follows:—

*Top Speed.*—The possible gain in efficiency, represented by a′, tends to increase with pitch, i.e., forward speed, for a given tip speed, but is only of the order of 2 per cent. for the highest pitch ratio (2.5) for which results are available.

*Climb.*—On climb at maximum power and r.p.m. at the supercharge height, the pitch ratio drops to about 2.0 under constant-speed operation, assuming an airscrew designed for peak efficiency at top speed, and at 2.5 pitch ratio. The possible efficiency recovery through contra-rotation increases owing to the reduced value of the advance constant, and is now about 4 per cent. As this corresponds to an appreciably greater percentage increase in rate of climb, it represents a valuable improvement in performance, although falling off somewhat with altitude, below the rated height.

*Take-off.*—It is evident that the advantage of dual rotation is greatest at slow speed, for a given airscrew-engine combination and altitude, since a′ varies inversely as J, to a first approximation. On the same assumptions as before, taking the data at the lowest available J value as applying to static conditions, the pitch ratio will be about 1.25 for a fully supercharged engine, and the efficiency increment 6 per cent. This does not represent the maximum possible gain, since for a high-speed aircraft the take off pitch ratio may be appreciably greater. If it is as high as 2.5, a rather extreme value, the gain becomes about 16 per cent.

Evidently it is only at the highest speeds that the full benefit of contra-rotating screws is obtained. Even the figures given do not represent the maximum possible advantage to be derived, since (a) they assume four blades, whereas actual installations may have six or more, with corresponding increase in the recoverable rotational efficiency loss; (b) it is known that vortex theory inflows and efficiency losses are greater than those of the simple momentum theory as used above. On the other hand, there may be some doubt about the efficiency of recovery being 100 per cent., as implied, since even a fixed wing behind a single-rotating screw probably effects partial recovery, although at the expense of some disturbance of the flow.

## BOOK REVIEW

*Aircraft Engines, Volume Two, by A. W. Judge. Chapman and Hall.* 30s.

THIS book follows Volume One by the same author, published recently, which was concerned with the theoretical and experimental aspects of the subject. Volume Two is more of a description of various engines, their components and accessories, and lubrication, ignition and exhaust systems. The book starts with a chapter on general design considerations, with a second on torque and balance. Then follows types of aircraft engines, with a separate chapter each for the radial and the sleeve valve. The chapter on components deals with such parts as pistons, crankcases, radiators, engine mountings and valve operation gear, but the chapter on accessories is devoted almost exclusively to engine starters and little else. Lubrication, ignition and exhaust systems are allotted one chapter each, but, strangely enough, there is not one for carburation or for supercharging, though particulars of superchargers are given at many places in the book. The description of the German petrol injection system is very short, although it seems likely that the controversy over the merits of this relative to the carburettor will be a major technical issue soon. The book ends with a very short chapter on testing, with little said about measuring power in flight or the design of engine test houses. "Aircraft Engines" is well illustrated with photographs of many British and American types, and has many sectional drawings and performance curves of great value for those requiring the information within the covers of one book.

# War in the Air

## Paratroops, Gliders and Air Transports Invade Crete

WITH the first streak of dawn of May 20th German parachute troops opened a full-scale invasion of the Island of Crete. Why the enemy need to occupy Crete is obvious, because it threatens the flank of any further drive they may make through Syria to Irak. If Crete is captured by the Germans, then it is to be expected that an attempt will then be made on Cyprus for the same reason.

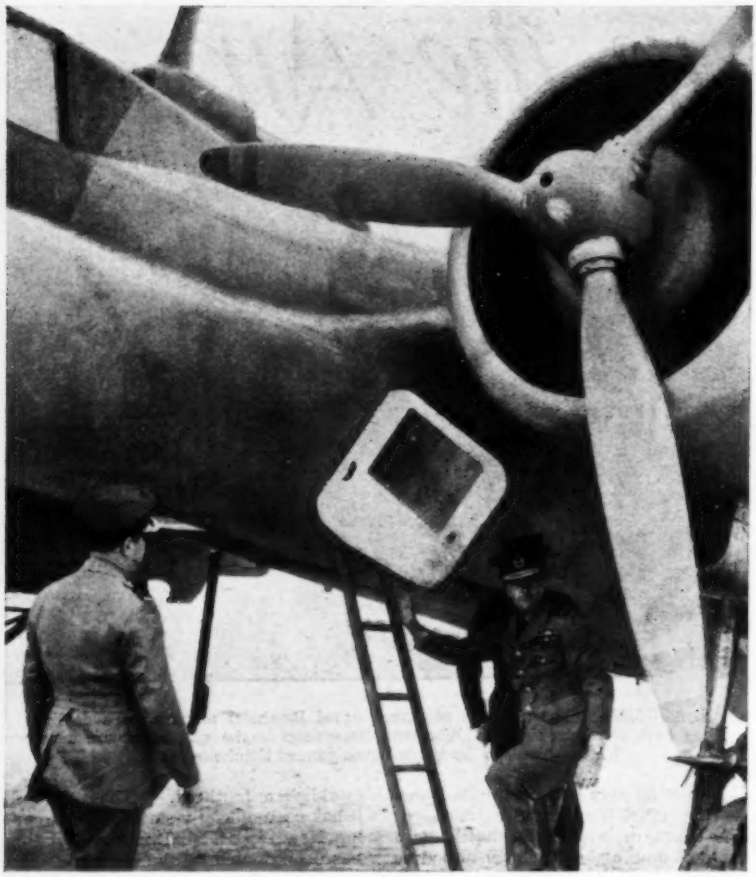
In order to obtain a clear picture of the pros and cons it is necessary to note the positions of the aerodromes available to the opposing sides. The nearest point of Greece to Crete is only some 60 miles away and the Greek aerodromes are less than 150 miles from the island. On Crete itself there are several areas which are referred to in war communiqués as aerodromes, but these are actually only in the nature of emergency landing grounds. The three which are of any real account are at Maleme, Retimo and Heraklion. The North African coast from which we must operate is about 200 miles distant. Owing to the inadequacy of the landing grounds in Crete our fighters had been withdrawn shortly before the attack materialised. The Germans opened the battle with terrific bombing—both level and dive—of the A.A. positions, towns, harbours and military works, and then landed some 1,500 air-borne troops to establish a foothold. These troops, it has been officially stated, were wearing New Zealand battledress, but this has been denied by the Germans, who say they have a colonial uniform which may be similar. By midday the same day our military authorities reported the situation to be in hand, with most of the invaders mopped up.

**ALL ABOARD: The air crew of a long-nosed Blenheim prepare for a daylight sweep over Northern France. The twin Brownings in the gun turret are a vast improvement on the single Lewis gunned Blenheim Mk 1.**

**SUBTERRANEAN AIRMEN: A group including some South African officers and N.C.O.s of the R.A.F. after their recent release from captivity at Asmara. In order to escape they had dug a tunnel from the inside of the hut they were sleeping in, one hundred and five feet long, and needed to dig a further fifteen feet to complete it. The work was started on January 9th and progressed at the rate of a foot-and-a-half a day; making detours round rocks they came across in their digging, each man working for thirty-five minutes at a time.**

### Air Divisions

LATER in the afternoon, after further intensive attacks by divebombing Junkers Ju 87s and ground-strafing Messerschmitts, another concentration of troops was dropped in the area around Suda Bay. Presumably the idea was to hold the port, the only one in Crete, in order that ship-transported supplies could be unloaded during the night. Within two hours the majority of these men had been accounted for. The actual number of air troops employed by the Germans for the initial invasion attempt is not known with any exactitude, but the expectation is that at least one, if not two, air-borne divisions, of 7,000 effectives each, were employed. A German air-borne division consists of two brigades of infantry each of three battalions, a brigade of artillery with 24 3in. guns, an anti-tank battalion with 37-mm. high-velocity guns and a number of specialised units. For transport the troops are expected to seize vehicles locally. Each infantry brigade has an infantry-gun company equipped with



**ALLIED DORNIER: Air Chief Marshal Sir Arthur Longmore examining a Yugo-Slavian Dornier Do 17 flown over to Egypt from the Balkans by a Yugo-Slav pilot.**

four 77-mm. mortars, and a quarter of the strength of each battalion have machine-guns as their weapons. The 3in. guns employed by the artillery brigade are what are commonly termed mountain guns. That is to say, they are of a type which can be easily and quickly erected from a number of smaller units of such a size that they can be carried by pack mules. In this case, of course, they are in units which can be dropped by parachute. When men and equipment are dropped from machines in formation the men would be released from the outer machines and the equipment from the centre in order that the unit tended to keep together rather than spread itself more than is necessary. Parachutes of various colours are used to enable the men to identify immediately the piece of equipment with which they are concerned. It has been computed—taking the Junkers Ju 52 as the aircraft used—that some 250 machine journeys are necessary to transport a division of air-borne troops.

The early stages of the battle are summed up in the short statement made in the House of Commons by Mr. Winston Churchill after the fighting had been in progress some two days.

"Fighting is continuing in intensity, and although the situation is in hand the Germans have gained some local successes at heavy cost. They are using large numbers of airborne and parachute troops, and these are being increased daily.

The position at Heraklion (Candia) is that our troops still hold the aerodrome, although the Germans are now what is called in occupation of the town, which probably means that they are ensconced in certain buildings in that town.

In the Retimo district there is no report of any particular fighting, although the attempt by the enemy to attack the area of the aerodrome earlier yesterday morning was successfully held.

In the Canea-Suda Bay sector heavy enemy air attacks in the early morning yesterday were followed during the course of the day by further parachute landings south-west of Canea, which were heavily engaged by our artillery and machine-guns.

## WAR IN THE AIR (Continued)

At Maleme aerodrome, 10 miles south-west of Canea, it appears that the enemy are now in occupation of the aerodrome and of the area to the west of it, but the aerodrome is still under our fire. Elsewhere in this sector the coastal line remains in our hands.

### Convoys Attacked

THE fighting is going on and deepening in intensity, and will certainly continue for some time. Last night the enemy began to try seaborne landings, but a convoy making for Crete was intercepted by our naval forces. Two transports and a number of caiques, Greek boats which probably contained troops intended for landing operations, were sunk, and an enemy destroyer which was escorting the convoy was also sunk.

But during the course of to-day very much larger attempts have been made by the enemy to carry an army into Crete, and a convoy of 30 vessels was discerned this morning by our forces and was presumably attacked by them. My information stops at that point. The convoy turned away towards the islands of the Archipelago and was being attacked by our destroyers and light forces.

I have not received any further information as to what happened, except that there has been a great deal of fighting during the day, the enemy air forces attacking our ships and we attacking the convoy. I am sorry to

**A TICKLISH BUSINESS: Searching a German airman before despatch to a prisoners-of-war camp.**

## WAR IN THE AIR (Continued)

say I have no definite information as to the results, but I feel that they can hardly be other than satisfactory in view of the naval forces of which we dispose in the Mediterranean.

It is a most strange and grim battle which is being fought. Our side have no air support because they have no aerodromes, not because they have no aeroplanes. The other side have very little or none of artillery or tanks. Neither side has any means of retreat. It is a desperate, grim battle."

### Quiet Nights

IN order to keep in chronological order we turn now to the air war in the West. For the period under review, night raiding on both sides has practically ceased, while daylight activity has increased. On the 21st an important daylight operation was carried out by a strong force of bombers accompanied by ample formations of Spitfires and Hurricanes as protectors. The target was the power station and oil refinery at Gosnay, near Bethune, in Occupied France. Shortly after crossing the French coast enemy fighters engaged our aircraft and a number of combats ensued. In spite of these the enemy was unable to prevent the success of the attack, direct hits being observed on both objectives.

Five enemy fighters were shot down, four by our fighters and one by our bombers. One of our bombers and six of our fighters are missing.

Since this target is over 50 miles inside occupied territory it is the equivalent of a German attack on London via Brighton. The Battle of Britain figures were more favourable to the defenders than these. On the same day a small force, also from the Bomber Command, made a daylight attack on the enemy naval base of Heligoland. Bombs were dropped and damage done in a raid carried out eight days previously was observed.

After six days' intense hand-to-hand fighting in Crete, accompanied by further reinforcements of the German airborne troops each day, the military position clarified itself. The Germans hold Maleme aerodrome and the area thereabouts, but the aerodrome is still within range of our artillery. Canea, Retimo and Heraklion have all been held against the air invasion.

In this show-down between the Royal Navy and the *Luftwaffe* military students will draw conclusions as to the relative value of the two arms. If the outcome is not clear beyond any doubt, each side will justify its arm with a series of "ifs and buts." Actually, of course, the position is entirely freakish. The value of the two arms should be assessed by considering their ability in harness, and not as independent units. Extravagant claims have already been made by the Axis as to the number of ships of the Royal Navy which have been sunk in this action. While it would be ridiculous to expect that we should not have losses, it is, at the same time, unwise, to say the least, to place any credence in their announcements.

An interesting feature of this air invasion is that the Axis did not tell their people until the operation had already been going for some three or four days. This betrays a nervousness which has not been noticeable in their invasions hitherto.

During the week-end came communiques from the R.A.F. Middle East Headquarters in Cairo referring to long-range fighters being used to lend some air support to our ground troops. No type of aircraft was mentioned, but it is probable that they are long-nosed Fighter Blenheims. These have a range of some 1,250 miles—possibly more with slight modification—and a speed of 295 m.p.h. Against Stukas, Ju 52s and gliders, they are all that is required, but dog-fighting with Me 109s and 110s would have them at a distinct disadvantage in both speed and fire power.

From further east comes the news of the capitulation of the Duke of Aosta at Amba Alagi with 18,000 troops. This leaves only comparatively small contingents still to be cleared up in Abyssinia. The R.A.F. and South African Force have worked with amazing courage and patience in this most successful campaign.

In Syria and Iraq the Royal Air Force attacked German aircraft on the aerodromes. On the outcome of the battle for Crete largely depends the immediate happenings in this area. As we go to press comes the announcement of the loss of H.M.S. *Hood* off Greenland in action against German naval forces, including the battleship *Bismarck*. In the ensuing chase, aircraft of the Fleet Air Arm—presumably from an aircraft carrier—scored at least one torpedo hit on the enemy.

**WAR IN IRAK: R.A.F. stations on the Irak-Transjordan frontier are guarded by the Arab Legion of the Amir of Transjordan. It is gratifying to note that we have out there the latest Long-nosed Blenheim with under turrets and see-behind blisters.**

**ENEMY AIR LOSSES TO MAY 24th**

| | Over G.B. | Over Europe | Middle East (Incl. Iraq) |
|---|---|---|---|
| May 18 | 3 | — | 22 |
| " 19 | 5 | — | 7 |
| " 20 | — | — | 5 |
| " 21 | — | 5 | 2 |
| " 22 | 2 | — | — |
| " 23 | — | — | 22 |
| " 24 | 1 | — | 15 |
| Totals | 11 | 5 | 73 |

Total in Northern Area: 4,634. Middle East: about 1,624

**BRITISH AIR LOSSES TO MAY 24th**

| | Over G.B. Aircraft | Over G.B. Pilots | Over Europe and the sea Aircraft | Middle East (Incl. Iraq) Aircraft |
|---|---|---|---|---|
| May 18 | 2 | 2 | — | 3 |
| " 19 | 4 | 1 | — | 1 |
| " 20 | — | — | — | 3 |
| " 21 | — | — | 8 | 1 |
| " 22 | — | — | — | 6 |
| " 23 | — | — | — | 2 |
| " 24 | — | — | 1 | 1 |
| Totals | 6 | 3 | 9 | 17 |

Total in Northern Area: 1,979. Middle East: about 238.

# ATLANTIC DELIVERIES

## *Choice of Route : Question of Safety : Influence on Design : Problem of the Fighter*

By ROGER TENNANT

MR. "Believe it or Not" Ripley has come across some quite sufficiently queer things in his time, but nothing he has ever said has shocked America quite so much as when he calmly announced that Charles Lindbergh was the sixty-first man to fly the North Atlantic non-stop. Two of his predecessors were Alcock and Brown; the other 58 were the crew of the British airship R-34, which flew from England to New York and back in 1919. Since then, with the scheduled services of the German airships, the Pan-American Clipper ships, the refuelled Empire flying boats, and the experimental flights of Imperial Airways, Luft Hansa, Air France, and American Export Air-lines, and the dozens of "stunt" flights, intentional and unintentional, with and without dinner jackets and ping-pong balls, those who have flown the Atlantic must run to thousands. Now that American aeroplanes are being delivered by air it seems likely to run to tens of thousands.

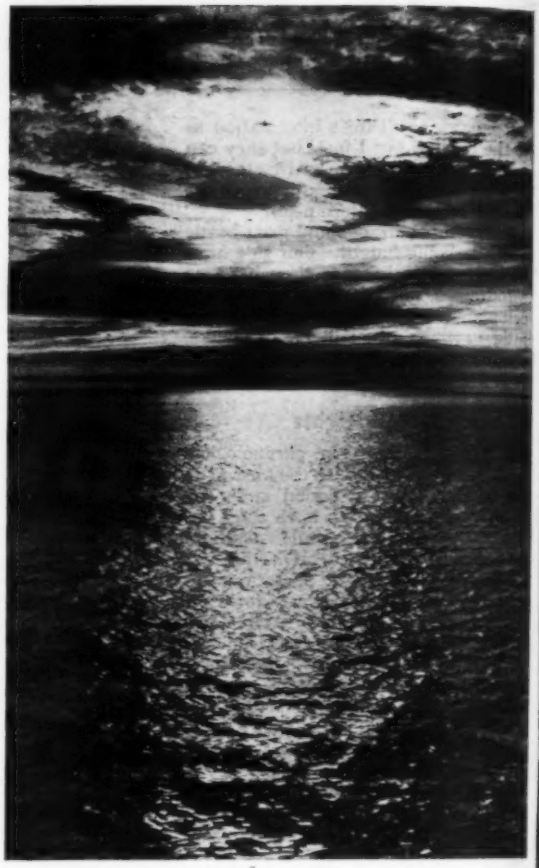
The whole value of American production depends on the ability of most of their aircraft to deliver themselves, for if every ship that we possess were put to ferrying aeroplanes it is still unlikely that we could keep pace with American production if it is to reach anything like its promised proportions, and those ships are needed for carrying other less mobile cargoes than aeronautical "ships." When and if America produces 500 aeroplanes a day, or even a week, they will not get here at all unless they fly here.

The ideal would be for every aeroplane manufactured for the R.A.F. to be delivered by air, and it is to be hoped that ultimately this will be possible. The most obvious difficulty is that a very large proportion of the aeroplanes at present in production in the United States are single-engined fighters and light bombers of some dozen varieties with insufficient range, at their normal loaded weight, to get across the water. There are two possible solutions to this problem: first, that of an Anglo-American production plan so closely co-operative that all the British aircraft firms could be put on to the construction of fighters and other short-range aircraft, leaving the Bomber Command to be maintained solely on American output, which would be directed almost entirely to the production of bombers, all of them having sufficient range to be delivered by air. Attractive as this scheme sounds, it requires a degree of co-operation and foresight quite without precedent in our conduct of this war, and it may be, in any case, a little late to begin to discuss such a scheme now. This leaves only the second alternative.

### North Atlantic Routes

A year or two ago one of our more eminent aeronautical personalities suggested that, in effect, there was nothing to flying the Atlantic, for one just got into an aeroplane, turned its nose westward, and sat there until the American coast appeared, at which one turned to the left. Mr. James Mollison replied that he had an aeroplane which had proved its ability to fly the Atlantic, so would the gentleman concerned care to borrow it and put the principle to test?

Without wishing to detract from the daring of those who have risked their own and other people's necks over the Atlantic, that does seem to be about all there is to flying east to west, although the adverse prevailing wind makes it a long journey, and most of the small aeroplanes that have got across, like Col. Fitzmaurice's pioneer crossing, have only *just* got across. Flying the other way does not seem to require a much higher degree of intelligence. One points the aeroplane eastwards, and unless one is Mr. Douglas Corrigan, one goes east, and arrives in Europe. Once upon a time it did not much matter whereabouts in Europe one finished up, as the flight just became a non-stop flight from America to wherever one ran out of petrol, and there is hardly a town in Europe that has not been thus honoured, but nowadays it seems more desirable to hit Great Britain, if possible.



On any long flight over water there is the hazard of engine failure, but in the case of the Atlantic the greatest dangers are those of weather—strong winds, thick clouds, rain, fog, and ice. The weather conditions vary according to the route chosen. Whatever the route, Newfoundland provides the point nearest to Europe for the start. From there, there are the alternatives of the Northern route via Greenland and Iceland, the direct route non-stop, and the Southern route via the Azores. The Northern route provides the shortest distance between landing grounds, as the longest hop is 780 miles, but the disadvantages are that the climate and weather are unsuitable, the nearness to the magnetic pole upsets both compass and radio, and the total distance is well over 3,000 miles compared with about 2,000 for the direct route. The Southern route has the best weather, but the total distance is again over 3,000 miles. Also, to follow the usual route via Lisbon would introduce political difficulties and the danger of enemy air action, whilst the flight direct from the Azores

## ATLANTIC DELIVERIES (Continued)

to Britain is not so very much shorter than the direct crossing from Newfoundland.

These comparisons are all based on Newfoundland as the starting point, but it must be remembered that a large number of the principal U.S. aircraft manufacturers are situated in California, so that in that case it might pay to fly straight across the continent to, say, Charleston, and then via Bermuda and the Azores. The total distance would then be less, but there would be almost twice as much over-water flying. Taking everything into consideration, the direct non-stop route from Newfoundland to Ireland or the west coast of England seems the best, but if we continue our criminally weak policy of allowing the Irish to intern any of our aircraft that land on their territory it seems likely that they will get enough American aeroplanes to become a major air power.

The advantages of the direct route are that it is the shortest in time and distance, and also provides the least over-water flying. The weather is reasonable except at certain times of the year, it enables the best advantage to be taken of the prevailing westerly winds and it nowhere approaches enemy country.

### The Weather

The non-stop distance from Botwood to Limerick is 2,010 miles. The actual range required of aircraft for the west to east crossing should not need to be so very much greater than this because the prevailing wind is westerly, and although there are occasional surface winds from the east, it appears that they rarely if ever extend higher than 10,000ft. Thus, although a range of 3,000 miles is desirable, 2,500 would be enough, having regard to the exigencies of war, to justify air delivery.

The direct route is liable to storms over the whole of its length, but by flying at 20,000ft. it should be possible to get above them. The relatively low rated altitude of most American engines is a disadvantage in this respect. 20,000ft. is somewhere near the most economical cruising altitude for a Merlin-engined aircraft, but there are not at present many American engines rated to the same altitude.

Thus, any strong winds are almost certain to be tailwinds. In the summer season the winds are gale strength on only 1-2 per cent. of the days, but in winter they occupy 10 per cent., and even more in parts. Fog is fairly common around Newfoundland, but is mostly low-lying, and should not cause any difficulty. Fog at the British end is also not uncommon, and makes the provision of alternative landing grounds necessary for winter operations.

Low-lying cloud is also prevalent over most of the route, but with modern equipment and methods of navigation this is not a serious handicap.

On the whole it can be said that during the summer months the west to east flight is reasonably safe for any aeroplane capable of flying 2,500 miles, whilst during the winter months flights should be limited to bombers with sufficient crew, equipment, and reserves of fuel to enable wide deviations to avoid bad weather and fog-bound aerodromes, and adequate de-icing equipment, as fitted to the latest American air liners.

In discussing his plan for the mass-production of 100,000 high-speed single-engined bombers in the United States, Mr. Pemberton-Billing recently suggested two additional safeguards for air delivery that seem worthy of serious consideration when production reaches really significant proportions. American promises of 500 aeroplanes a day are not to be laughed at, coming from a country that measures its motor car production in tens of millions, and five aeroplanes a day from a hundred plants is not a big order for such resources.

Even if we contemplate all-the-year-round deliveries there will probably be 30 or so days a year when flights are not advisable, and roughly 30 per cent. of the aircraft are likely to be types that can safely be flown over only in the summer, so that deliveries of 1,000 aeroplanes a day must be budgeted for. It will thus be necessary to get them off at about minute intervals, if they are all to follow the same route, which seems most desirable, as organised rescue arrangements can then be set up.

P.-B.'s first proposal is to send off four-engined flying boats in the line, one every hour, so that there is one to every 60 machines; then if an engine fails or anything else occurs to force the pilot down on the water it will be the flying boat's duty to alight and pick up the crew. If the sea is running too high to permit this they will have to depend on surface vessels guided by the boat. To this end, it is proposed that 19 armed ships should be anchored across the route at 100-mile intervals, so that there will always be one within about 50 miles or less, which is well within the gliding range of any modern aeroplane flying higher than 15,000 feet. The ships would be provided with fast motor-boats and special lifeboats for heavy seas.

### Effect on Aircraft Design

Assuming that the war is to continue for sufficient time for further new types to be designed and put into production, the question arises as to whether it will pay to consider the requirements of air delivery in deciding the original specification. Any bomber of a gross weight of more than about 15,000 lb. will automatically have sufficient range if its bomb load is replaced by temporary additional tanks, but there is still the question of its performance with an engine stopped or under icing conditions.

One of the most important developments in this respect is the introduction of so-called "streamline" flaps, which can be used to provide large increases in lift with comparatively little additional drag. The minimum power required for level flight depends on the value of $C_D / C_L^{3/2}$, so that high lift flaps are of considerable assistance despite the fact that they may appreciably reduce the L/D. The Youngman flap comes into this category, and also the Fowler flap already fitted to the Lockheed and Consolidated bombers, used in its semi-extended position. The new N.A.C.A. venetian blind flap is of even greater value and will improve the rate of climb and ceiling of a typical modern aeroplane with one engine stopped by as much as 30 per cent. These flaps have the disadvantage that they do not steepen the glide so much for landing, so that an additional air brake is desirable.

Other probable effects of the Atlantic on American design are provision for the easy fitting and removal of safe additional fuel tanks; provision for overload take-offs in deciding undercarriage factors; fitting of full de-icing equipment (there seems to be a need for a removable de-icer because carrying de-icers all through the summer means, altogether, several hundred tons less explosive delivered on Berlin, which is a serious matter); provision for the temporary removal and storing inside of gun turrets and other projecting military equipment likely seriously to affect the L/D, and consequently the range; provision for fitting additional navigational instruments and equipment to such fighter aircraft as are considered suitable for flight delivery; and, finally, the possible provision for some form of assisted take-off for small aircraft, either as a normal method of launching or for the Atlantic trip only.

### The Big Bombers

Types which would be capable of flying over with no modification whatsoever are the Boeing B-17, which with full tanks can fly about 3,100 miles non-stop, the cost in fuel and oil being somewhere about £500; the Martin 162

## ATLANTIC DELIVERIES (Continued)

boat; and the Consolidated family, the twin-engined PBY, the four-engined PB2Y, and the newer Liberator and Model 31, either of which could all but fly to England the other way round the world. The Douglas Digby or B-18, and its development, the DB.320, and the newer Martin heavy bomber also have ample disposable load, although they may require additional tankage.

### The Medium Bombers

The Lockheed Hudson, in its civil version, flew the Atlantic with ease long before the war, after Howard Hughes had got it unstuck at 50 lb./sq. ft. loading, and the Hudsons and Venturas are now being flown across with temporary additional tanks, which should not require an overload take-off. The Douglas DB.7 or Boston in its various forms carries slightly more load than the Ventura, so it should be quite capable of delivering itself. The somewhat higher fuel consumption of the newer version with 1,600 h.p. engines will presumably be balanced by an increase in the permissible take-off loading. This seems likely to be the fastest entrant, and with a 40 m.p.h. tail-wind should get across in less than six hours. The Martin Maryland and the North American NA-40A, which are successively bigger, can also be flown over with addi tional tankage.

### The Fighters

That completes all the aeroplanes capable of getitng across with additional tanks where necessary, but without any over-loading, and as all are twin-engined and adequately equipped, they should be capable of all-the-year-round delivery without undue risk.

We now come to the less simple problem of the smaller single-engined aircraft—the dive bomber, reconnaissance and fighter types, with which can be included the twin-engined fighters. As they seem likely to constitute 30-50 per cent. of the total production, it is most essential to provide for their delivery by air.

Before discussing ways and means of getting them across, it is necessary to dispose of the question as to whether the sending of single-engined aircraft across the Atlantic is a permissible hazard. So far, 34 single-engined aeroplanes have safely crossed the North Atlantic. Of the number that have not quite, there is not so complete a record, but from memory I can recall only three—Harry Hawker's lucky escape, which in view of the improvement in engine reliability since 1919 cannot be seriously considered in relation to the present problem, and even less can one consider the pop-bottle Aeronca, which should never have been allowed to leave. The only other unlucky attempt I can recall was the Bellanca, with two Hungarians, which, in view of the fact that ten other single-engined Bellancas have got across, is not so bad.

Of the 34 single engined aeroplanes that have succeeded, all except Mollison's last crossing in the Bellanca 28-70 and Merrill's two flights in the Vultee, have been in very slow and unsuitable aeroplanes. Jim Mollison, for instance, made the precarious east to west crossing in 1932 in a Puss Moth. Mrs. Markham did the same journey in a Vega Gull, and most of the rest have been early Bellancas, Ryans and Vegas, usually taking about twenty hours to cover 2,000 miles, so that even with tail winds, the average cruising speed has been about 100 m.p.h., which means that the time spent over the water was from two to three times as long as would be taken by a modern fighter or light bomber. This means that, apart from the improvement in the quality and reliability of aircraft and engines, the period of risk is in any case only a half to a third that of the early flights.

Furthermore, if the additional precautions advocated by Mr. Pemberton-Billing are instituted—the provision of big flying boats for rescue work and ships always within gliding-distance—and if the pilots have a good strong homing note to keep them on their course, the hazards would seem to be reduced to well below those encountered in normal Service flying over enemy country.

If, therefore, we accept, subject to a satisfactory organisation, the reasonableness of crossing the Atlantic in a fast single-engined aeroplane, the problem is reduced to that of giving the aeroplane the necessary range to get across with an adequate reserve.

Most of these single-engined types have normal ranges of from 600 to 1,000 miles with military load. These ranges can be increased (1) by flying at a smaller throttle opening, and consequent lower speed. This is not altogether desirable as it increases the time over the water, and in any case the combination of low aspect-ratio and high wing-loading on most of the newer American fighters does not afford a very great increase in this manner. (2) By adding extra tanks, probably on the outside, and making an overload take-off. If necessary, military equipment such as guns could be removed and flown over in larger types such as the Liberator. (3) If the aircraft cannot make a safe take-off with the extra load some form of assisted take-off may be necessary.

The only American fighter on which sufficient data is available to enable its range to be approximated is the Curtiss Mohawk, which is fairly typical, though slightly below the performance of the latest types. Its normal range is 677 miles at 260 m.p.h., which means that the fuel consumption must be something like 37 Imperial gallons an hour. To fly a further 1,800 miles would require about 266 gallons, or 2,000 lb. of petrol. This would increase the loaded weight to about 7,750 lb., corresponding to a wing-loading of just under 33 lb./sq. ft.

### Overloads not Serious

This does not appear serious at all. The undercarriage should be quite capable of taking the extra weight for a careful take-off, in view of the fact that the loads received in taking off should never approach those incurred in landing, whilst the load factors for the rest of the structure are ample. The effect of the extra weight on the flying performance would be very slight—about 5 m.p.h. reduction in speed—but the extra fuel would have to be carried externally, which would cause a further, not inconsiderable, reduction in speed.

Two hundred and sixty gallons requires about 40 cu. ft. of space. It could be carried in the form of a belly tank along the bottom of the engine cowl and fuselage, about 2ft. deep and 10ft. long, or in the form of two streamlined tanks on struts below the wing in the manner of the Wellesley's bomb containers. The Mohawk is fitted with flush-fitting bomb racks, which might be used as attachment points.

### High Wing-loadings

Most other American fighters would be amenable to similar temporary modification, although for a type with an initial wing loading as high as the NA. Mustang it would involve taking off at about 41 lb./sq. ft. But with the power loading at 8.5 lb./h.p. it should get off without difficulty, as the Liberator bomber takes off normally at similar loadings. The two-seaters, such as the Brewster Bermuda and Douglas DB8-A, will be better off, as the overload will be relatively less and could probably be contained inside the fuselage.

Thus, as far as the summer months are concerned, it would appear to be practical to ferry even the smallest types by air, and, in view of the increasing acuteness of the shipping problem, it seems very desirable that immediate experiments be undertaken to prove the feasibility of temporarily increasing the range of these aircraft.

# Service Aviation

## Royal Air Force and Fleet Air Arm News and Announcements

### Taranto Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty:

DISTINGUISHED SERVICE ORDER.

Lts. E. W. Clifford and G. R. M. Going.

BAR TO D.S.C.

Sub. Lt. (A) P. D. J. Suarke.

DISTINGUISHED SERVICE CROSS.

Lts. R. W. V. Hamilton, H. R. B. Janvrin, N. M. Kemp, A. W. F. Sutton, F. M. A. Torrens-Spence; Lts. (A) L. J. Kiggell, C. S. E. Lea; Sub. Lts. (A) R. A. Bailey, P. D. Jones, A. S. D. Macaulay, J. W. Neale, J. R. B. Weekes and A. L. O. Wray.

The above are all officers of the aircraft carrier *H.M.S. Illustrious*. The awards are for outstanding courage and skill in the Fleet Air Arm torpedo attack on the Italian Fleet in Taranto Harbour on November 11th, 1940.

### London Gazette

#### Royal Air Force

*Air Ministry,*
*May 16, 1941.*

*General Duties Branch.*

The follg. are granted permt. comms. in substve. rank of Flt. Lt.:—(Oct. 19, 1940) Flt. Lt. (temp. Sqn. Ldr. R. I. K. Edwards; (Apr. 16) Flt. Lt. (temp. Sqn. Ldr.) P. G. Heath, H. B. Johnson.

The follg. are granted temp. commns. as P/Os. on being employed with R.A.F. (Apr. 19):—G. H. Campbell-Colquhoun, Lt. Middx. R., R. M. Cundy, Lt. R.A., R. A. Paddock, Lt. R. War. R., D. B. Alun Williams, 2nd Lt. Dorset R., W. B. Berry, 2nd Lt. R.A., J. J. Davies, 2nd Lt. R.A.C., T.A., A. G. Gibb, 2nd Lt. H.L.I., P. A. L. Gomperiz, 2nd Lt. R.A., C. A. Harrap, 2nd Lt. R.H.A., V. G. Houchin, 2nd Lt. Essex R., J. Hugan, 2nd Lt. Cameronians, C. H. S. Kirkus, 2nd Lt. R.A., C. W. A. Lyons, 2nd Lt. R.A., I. G. Maclaran, 2nd Lt. R.A., W. R. Mummery, 2nd Lt. R.A., A. M. Pollitt, 2nd Lt. The S. Stafford R., D. A. Reynolds, 2nd Lt. R.A., E. A. U. Smith, 2nd Lt. King's Own R., T. C. Usher, 2nd Lt. R.A., P. T. Ward, 2nd Lt. R.A., A. P. Whicher, 2nd Lt. Dorset R., N. V. B. Whitehouse, 2nd Lt. R.E.

The follg. are granted comms. for duration of hostilities as P/Os. on probn.:—Flt. Sgt.: (Apr. 19) W. Snowden. Temp. Flt. Sgt.: (Apr. 11, sen. Dec. 17, 1940) T. R. Lamb. Sgts.: (Mar. 25) C. A. Hodder, W. J. Sears; (Apr. 7) N. Hearn-Phillips, D.F.M.; (Apr. 10) G. W. Horton; (Apr. 16) S. Robinson, D.F.M.; (Apr. 17) J. H. Braybrooks, T. E. Bolton; (Apr. 22) R. T. Billett.

The follg. F/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of Flt. Lt. (Apr. 1):—C. W. Francis, J. P. Ridge.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Feb. 21) C. V. Brown; (Feb. 28) R. H. Dibnah; (Mar. 7) C. E. Beloe, T. de T. MacDonald, J. A. Sowrey; (Apr. 1) R. Alexander, H. Arden, A. E. Ballam, A.F.M., J. G. Barr, L. R. Barr, G. G. N. Barrett, W. J. Barrett, A.F.C., N. L. Baugh, G. H. Bennions, D.F.C., H. D. Bisley, J. Blackburn, H. F. Bucknell, R. P. Bugler, R. Burch, H. V. Bunting, B. E. Crawley, E. Cotton, D. M. Egan, C. Dunkerley, D. J. Evans, J. A. Eyre, F. R. Flynn, J. D. R. Forbes, G. S. Forbes, E. G. Fraser, J. T. Freeman, E. M. Gibbs, H. B. Gray, A.F.M., R. J. Harden, G. F. Harcourt-Powell, P. B. Hennessy, W. C. Hutchings, D.F.C., A. B. Jones, T. W. Kean, A.F.C., A. S. Knowles, E. N. Lewis, D.F.C., G. D. Lyster, D.F.C., T. G. Mahaddie, W. C. Maher, A.F.M., R. Maun, J. Northrop, E. C. Oldfield, F. Parvin, P. C. Price, B. C. Ridd, C. L. Rolfe, D. Shaw, W. A. Shillito, E. A. Shipman, J. S. Tucker, J. D. Varley, W. D. Winward, J. B. Weightman, D.F.C., G. H. Womersley, E. Womphrey, A. L. Woode, C. Wright, A. O'Connell; (Apr. 9) R. J. Neal; (Apr. 30) J. S. Simons, A.F.C.

Act P/O. on probn B. W. Vickers is confirmed in his appt. and graded as P/O. (Sept. 3, 1940, sen. Dec. 9, 1939).

Flt. Lt. A. E. Rogenhagen (ret.) is promoted to rank of Sqn. Ldr. (temp.) (Mar. 11).

The follg. P/Os. are promoted to war substve. rank of Flt. Lt.:—(Dec 6, 1940) H. G. Hardman; (Feb. 12) A. Q. Cairns; (Feb. 18) P. E. Barnes, A. J. H. Finch; (Mar. 5) P. C. Lambert; (Mar. 21) R. E. Smissen; (Mar. 23) H. H. Haszard, I. K. C. Palmer, W. H. Tremear; (Mar. 24) A. B. S. Holdsworth; (Mar. 27) J. H. Crossley, P. H. Knowles, A.F.C., J. H. Player; (Apr. 7) B. A. Rogers; (Apr. 10) The Hon. R. A. G. Baird; (Apr. 12) P. F. McD. Davies; (Apr. 17) P. R. Burton-Gyles, D.F.C.; (Apr. 23) W. D. K. Franklin, C. N. McVeigh; (Apr. 25) R. Bows, G. G. Heathcote, R. A. Nicholson.

The follg. P/Os. are promoted to war substve. rank of F/O:—(June 27, 1940) D. J. Penman, D.F.C. (substd. for notifn. of Oct. 22, 1940); (Aug. 21, 1940) R. L. H. Harris; (Dec. 9, 1940) B. W. Vickers; (Jan. 13) B. G. Aston; (Mar. 2) B. R. Mercer, B. A. Primavesi, F. T. Roberts, J. N. Westcott; (Mar. 7) R. D. Robertson (2nd Lt., Seaforths), T. F. Guest (2nd Lt., Gloster R., T.A.), A. C. Chaldecott (2nd Lt., R.E., T.A.); (Mar. 24) A. D. Alexander, D. A. Young; (Mar. 30) R. Reeve; (Apr. 6) A. R. McL. Campbell, P. E. Henn, W. P. Hopkin, C. A. McGaw, A. G. Maycock, R. H. Morton; (Apr. 9) R. J. A. Leslie, N. Paterson; (Apr. 10) H. C. Winter-Taylor; (Apr. 11) E. I. J. Bell (2nd Lt., N. Staffs. R.), K. O. Sayers (2nd Lt., Middx. R., T.A.), R. H. Wheeler, (2nd. Lt., R. Tank R.), H. W. Wakefield (2nd Lt., R.A., T.A.); (Apr. 13) R. W. H. Carter; (Apr. 12) C. R. Glen, A. J. Smith; (Apr. 20) J. O. Alexander, J. C. R. Clarke, W. P. Collins, E. L. Davies, B. Duncan, C. G. Frizell, R. F. Harman, D.F.C., H. W. Jones, A. S. Judson R. F. S. Marriott, S. W. Martin, H. E. Martineau, R. Mottram, M. Parry, C. H.

**CALIFORNIAN KINDNESS: The Lockheed Hudson presented to the R.A.F. by the employees of the Lockheed Vega Corporation. It arrived by air across the Atlantic and is now on service with the Coastal Command.**

**IN ITS ELEMENT: Two pilots trying to catch the squadron mascot Wilfred. The Mae Wests seem a little unnecessary for the quantity of water.**

# SERVICE AVIATION (Continued)

Saunders, D. J. T. Sharp, P. D. Short, G. R. Woolf, K. B. Wright; (Apr. 27) P. G. Cooper; (Apr. 28) G. G. F. Draper, L. F. Penny, M. V. Redfearn-Smith.

P/O. N. D. Sinclair is granted war substve. rank of F/O. (Feb. 19).

The follg. Sqn. Ldrs. are transfd. to Technical Branch (Apr. 24, 1940):—F. C. de la P. Beresford-Peirse, H. Norrington, A. H. Simmonds.

P/O. A. Allan (2nd Lt., R.A.) relinquishes his temp. commn. on return to Army duty (Apr. 10).

*Technical Branch.*

The follg. are granted commns. for duration of hostilities as F/Os. on probn.:— W/Os.: (Mar. 12, sen. Nov. 22, 1940) S. G. Dawson; (Apr. 21) E. F. Hancock. As P/Os. on probn.:—W/O.: (Apr. 4) A. H. Kidson. Sgt.: (Apr. 26) M. U. Tinsley.

The follg. Sqn. Ldrs. are promoted to rank of Wing Cdr. (temp.):—(Sept. 1, 1940) A. H. Simmonds; (Mar. 1) F. C. de la P. Beresford-Peirse.

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Apr. 6) E. W. Walker; (Apr. 14) M. J. Grennan; (Apr. 20) E. A. Sillitoe.

P/O. on probn. A. A. McLaren is promoted to war substve. rank of F/O. on probn. (Feb. 1).

P/O. T. C. Pratley is granted war substve. rank of F/O. (Mar 12).

*Administrative and Special Duties Branch.*

The follg. are granted commns. for duration of hostilities as F/Os. on probn.:— W/Os.: (Apr. 20) W. C. Alders; (Apr. 21) G. Smith. As P/Os. on probn.:—W/Os. (Apr. 17) C. S. Bray; (Apl. 18) T. F. Puppet. Flt. Sgt.: (Apr. 19) E. F. Williams. Sgt.: (Apr. 11) W. M. Clements. As Act. P/Os. on probn.: Flt. Sgts.: (Apr. 25) E. C. Millett; (Apr. 26) R. Jenkins. Sgt.: (Apr. 25) B. Dill. Cpl.: (Apr. 25) J. S. J. Buels. L.A/C.: (Apr. 19) M. J. T. Langdon.

The follg. Act. P/Os. on probn. are graded as P/Os. on probn. (Apr. 11):— J. Robinson, G. Mitchell, J. A. Lewis.

The follg. P/Os on probn. are promoted to war substve. rank of F/O. on probn.:—(Feb. 1) G. McKenna; (Mar. 1) F. J. Davey; (Apr. 1) E. E. Smith.

The follg. are transfd. to Technical Branch:—F/Os. on probn.: (Jan. 12) W. C. Burton, G. J. Lloyd; (Jan. 26) W. Walster; (Feb. 10) W. D. Coleman. P/O.: (Sept. 14, 1940) E. T. McCabe. P/Os. on probn.: (Dec. 20, 1940) H. F. Kennedy; (Jan 12) C. Couzens, L. J. Cratchley, H. E. Howard, A. Paterson, H. A. Paton, J. R. Porter, R. W. Searles, J. K. McK. Semple; (Jan. 25) R. C. Spicer; (Feb. 10) E. D. Anderson; (Mar. 10) A. McArdle; (Mar. 28) W. E. Shaw, R. Williams.

F/O. R. A. Robertson relinquishes rank of F/O. at own request and is transfd. to General Duties Branch in rank of P/O. (Apr. 6).

*Equipment Branch.*

The follg. are granted commns. for duration of hostilities as F/Os. on probn.:—W/Os.: (Apr. 15) J. H. Riste, E. A. G. Kirk. As P/Os. on probn.:—W/Os.: (Apr. 25) E. G. Le Maistre, J. J. Lea.

P/O. C. S. Reade is confirmed in his appt. (Aug. 17, 1940) and granted war substve. rank of F/O. (Sept. 1, 1940).

F/O. M. A. Palethorpe is transfd. to Administrative and Special Duties Branch (Apr. 15).

The notifns. of Jan. 14, Jan. 21, and Feb. 28 concerning P/O. C. S. Reade are cancelled.

*Accountant Branch.*

The follg. Act. P/Os. on probn. are graded as P/Os. on probn.:—(Apr. 19) P. G. Sawyer, G. H. Earp.

Wing Cdr. R. J. Wishlade is placed on retired list on account of ill-health (May 10).

## *Royal Air Force Reserve*

RESERVE OF AIR FORCE OFFICERS

*General Duties Branch.*

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Jan. 6) R. G. Burke, A.F.C.; (Jan. 27) M. J. Baird-Smith, D.F.C.; (Feb. 18) R. P. J. Radbourne; (Mar. 23) J. C. Holman; (Mar. 28) F. P. J. McGevor, D.F.M.

Flt. Lt. R. H. Holmes is transferred to Technical Branch (Apr. 24, 1940).

Group Capt. P. R. Chambers relinquishes his commn. in class CC on cessation of duty (Mar. 31).

*Technical Branch.*

Flt. Lt. R. H. Holmes is promoted to rank of Sqn. Ldr. (temp.) (Sept. 1, 1940)

*Administrative and Special Duties Branch.*

The follg. are transferred to Technical Branch:—F/O. on probn.: (Jan. 12) W. J. Walker. P/Os. on probn.: (Dec. 6, 1940) J. H. Sewell; (Jan. 12) L. J. Nolder, C. H. Sexton, N. W. Turner, E. J. Watts.

## *Royal Air Force Volunteer Reserve*

*General Duties Branch.*

The follg. are granted commns. for duration of hostilities as F/Os.:—(Apr. 5) I. Bellas, E. W. Bjorck, R. K. Clark, C. E. Tanner. As P/Os. on probn.:—Sgts. (Feb 22) J. W. Hunt, I. P. B. Denton, G. H. T. Eades, F. M. V. Johnstone, R. L. Lloyd, P. Neale, C. J. Pearson, H. H. Pearson, N. F. Thompson, M. G. Williams; (Apr. 10) S. D. Plummer; (Apr. 14) J. R. Howard, D. F. Dennis; (Apr. 16) R. Cook; (Apr. 17) N. T. C. Swanwick; (Apr. 18) E. W. Tipple; (Mar. 19) H. Sawdon; (Apr. 20) J. Fenwick-Webb; V. D. Durham; (Apr. 22) F. C. Blackmore; (Apr. 23) J. C. Stevenson, R. A. Jell; (Apr. 24) P. Dobson, F. K. Bainbridge. L.A/C.: (Feb 17) G. H. McArthur; (Feb. 22) H. F. Bickerdike, D. E. W. Brown; (Mar. 9) J. G. Nowell, G. V. Wilson; (Mar. 16) N. McCarthy, C. M. C. Woolroffe; (Mar. 24) C. J. Beer, L. H. E. Bridge; (Apr. 6) N. H. Carfoot, A. J. Challis, A. Elliott, R. W. S. Inge, C. H. L. James, H. R. Lanchester, G. H. Malcolm, A. E. Odle, D. O. Osborne; (Apr. 13) J. P. Bartlett, L. W. Brown, E. P. Byrom, T. F. J. Crudden, J. Finch, L. M. M. Galea, D. M. Gall, P. A. Gifkins, W. D. C. Hardie, L. Hayton, A. R. W. Hill, J. C. Jenkins, G. P. Mandeville, E. P. G. Moyna M. H. R. Namias, M. R. P. Oxley, D. Page, C. Thomas, R. R. Williams, N. G. Wingfield; (Apr. 20) P. Brown, N. A. Cooper, L. M. Sweeney. As Act. P/O. on probn. (Jan. 15) E. H. Spencer.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Feb. 10) K. C. Garvie; (Mar. 7) R. K. Browning, H. W. Cottam; ((Mar. 10) A. G. Middleton; (Mar. 16) M. E. Shields; (Mar. 17) D. E. Patterson; (Apr. 1) W. H. H. Mussett, J. L. Hubbard, P. E. Bedell, G. W. Haigh; (Apr. 7) N. O. F. E. Walker, S. W. F. Palmer, F. H. Martin, D.F.C., R. D. Leach, J. Annandale; (Apr. 11) D. Crowley-Milling, D.F.C., L. C. Hatt; (Apr. 17) L. A. Stewart, D.F.C., D. Stewart-Clark; (Apr. 30) L. W. Farrow.

P/O. on probn. A. D. L. Mackinnon is confirmed in his appt. (Jan. 13), and promoted to war substve. rank of F/O. (Mar. 9).

P/O. on probn. J. A. C. Houghton is confirmed in his appt. (Feb. 3) and promoted to war substve. rank of F/O. (Mar. 16).

The follg. P/Os. on probn. are confirmed in their appts. (Mar. 2) and promoted to war substve. rank of F/O. (Apr. 6):—K. W. Robinson, N. G. Wilson.

P/O. on probn. N. H. Sagar, D.C.M., is confirmed in his appt. (Feb. 10), and promoted to war substve. rank of F/O. (Apr. 19).

The follg. P/Os. on probn. are confirmed in their appts. (Mar. 9), and promoted to war substve. rank of F/O. (Apr. 20):—E. Bingham, F. Pichel-Juan, J. A. Rogers.

The follg. P/Os. on probn. are confirmed in their appts. (Mar. 9), and promoted to war substve. rank of F/O. (Apr. 22):—A. W. Court, J. O. W. K. Ferris, G. E. Fletcher.

P/O. on probn. L. S. Downes is confirmed in his appt. (Mar. 29), and promoted to war substve. rank of F/O. (May 13).

P/O. on probn. A. H. Van Bergen is confirmed in his appt. (Apr. 20), and promoted to war substve. rank of F/O. (May 13).

The follg. F/Os. are promoted to war substve. rank of Flt. Lt.:—(Dec. 3, 1940) R. G. Wilbertorce; (Feb. 11) L. E. Clark, D.F.C.; (Mar. 17) C. H. Hartley; (Mar. 21) M. C. H. Barber; (Apr. 18) A. D. McN. Boyd.

P/O. M. R. Hill is promoted to war substve. rank of F/O. (Aug. 9, 1940).

F/O. F. E. Barnes is transfd. to Technical Branch (Oct. 5, 1940).

The commn. of P/O. on probn. J. F. McKee is terminated on cessation of duty (May 6).

Flt. Lt. H. N. Edge is dismissed the Service by sentence of G.C.M. (Apr. 12).

*Technical Branch.*

W/O. E. H. Newport is granted a commn. for duration of hostilities as P/O. on probn (Apr. 20. Sen. Nov. 29, 1940.)

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Feb. 1) R. R. Richardson; (Feb. 12) C. S. Prentice; (Mar. 15) H. F. Blackmore; (Mar. 31) R. C. M. Young; (Apr. 1) R. A. V. Dismore; (Apr. 15) J. L. Western.

F/O. J. Scott-Taggart, M.C., is granted war substve. rank of Flt. Lt. (Feb. 23).

The follg. P/Os. are granted war substve. rank of F/O.:—(Mar. 11, 1940) W. C. Fahie; (Apr. 5, 1940) E. C. Greaves; (May 25, 1940) J. G. Ratcliff, (July 28, 1940) C. C. Newton-Wade; (Sept. 15, 1940) E. F. O. Masters; (Feb. 11) F. A. Horley.

The notifn. of Jan. 14 concerning P/O. P. Allden is cancelled.

*Balloon Branch.*

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—Sgt.: (Apr. 22) H. H. Knighton. Cpls.: (Mar. 31) A. J. Doddington; (Apr. 21) L. M. Lewis; (Apr. 22) R. T. Young. L.A/C.: (Apr. 21) L. W. Turner. A/C.1: (Apr. 15) E. Stocks; (Apr. 21) J. E. Sutty.

P/O. J. G. O. Roberts is granted war substve. rank of F/O. (Jan. 20).

*Administrative and Special Duties Branch.*

The follg. are granted commns. for duration of hostilities as P/Os. on probn.:—(Aug. 27, 1940) D. A. L. Campbell; (Dec. 6, 1940) L. C. Brown; (Jan. 1) P. E. Pirie; (Jan. 4) H. J. Bell; (Jan. 15) L. J. P. Swabey; (Feb. 7) C. D. F. Hume; (Feb. 18) P. H. Mayne; (Mar. 4) W. A. Chase; (Mar. 19) L. A. Barrett, E. F. A. Helloway; (Mar. 21) L. T. Jones; (Mar. 25) L. S. L. Springer; (Mar. 28) E. I. Halliday; (Mar. 31) W. E. Motley; (Apr. 4) H. F. Macgregor; (Apr. 9) T. C. L. Brown; (Apr. 11) R. O. Critchley, W. M. Green, S. M. Spence, J. Taylor, J. Thompson, W. J. J. Walsh, C. J. White; (Apr. 12) N. Beanland, W. S. Bell, C. B. Casey, D. G. Dunthorn, E. J. B. Eaton, B. Ord, P. H. Shepherd, S. N. Yeomans; (Apr. 15) F. Brown, D. A. Langdon, J. A. Menhams, G. H. Stevens; (Apr. 16) E. McCormac; (Apr. 18) H. Ginn, (Apr. 19) H. G. Thomson; (Apr. 21) J. M. Thoday; (Apr. 23) T. N. P. G. Sandeman; (Apr. 24) W. Dunkels, C. F. Green, J. C. Payne; (Apr. 25) J. Wright-Bevans; (Apr. 28) T. W. Bailes, S. H. Hopper, B. C. Lucia, R. H. Martin, F. L. O'Shaughnessy, J. C. Roberts, J. E. V. Shepphard, J. Thomson, J. B. Barclay. L.A/C.: (Apr. 16) G. R. Lillis. As Act. P/Os. on probn.:—Sgts.: (Apr. 25) C. H. Thompson, J. L. Walter. Cpls.: (Apr. 18) D. N. Harris; (Apr. 25) C. G. de T. Heelis, T. F. Ryalls, W. R. Wooldridge. L.A/C.: (Apr. 19) R. E. Thompson; (Apr. 25) B. M. Congbeare, L. T. Field. A/C.2: (Mar. 24) T. S. F. Flannery; (Apr. 7) A. S. Ireland; (Apr. 18) L. H. Sandiford, C. E. B. Du Cane; (Apr. 19) F. Dean; (Apr. 25) R. B. Barnett, L. E. Griffiths, L. Brittain-Cain, G. H. Windsor.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to rank of F/O.:—(Aug. 14, 1939) A. Haynes (substd. for notifn. of Sept. 26, 1939); (Jan. 1) J. Phillips.

The follg. P/Os. on probn. are confirmed in their appts. and promoted to war substve. rank of F/O.:—(Dec. 9, 1940) V. Rendle; (Feb. 5) V. Millard; (Feb. 14) D. H. Jones; (Feb. 20) J. F. Warren; (Feb. 25) H. O. Evans; (Feb. 27) T. J. Mordecai; (Mar. 14) J. H. Smith; (Mar. 15) C. R. P. Cullum, L. L. Walters; (Mar. 16)

**FOR PROTECTION FROM WHOM? The 7.9 mm. Rheinmetall-Borzig guns taken from the wreck of the Me 110 on which Rudolf Hess escaped to Scotland.**

# SERVICE AVIATION (Continued)

W. Parke; (Mar. 21) L. Shaffi; (Mar. 23) W. B. Sinclair; (Mar. 25) R. Brown; (Apr. 5) R. B. Sanderson; (Apr. 7) T. E. S. Norris; (Apr. 8) W. F. Lowe, (Apr. 11) E. T. W. Lander; (Apr. 15) E. H. Chambers; (Apr. 19) S. M. Krusin; (Apr. 21) R. E. Spray; (Apr. 27) J. A. Porter, H. F. G. Wood; (Apr. 28) D. P. Jones; (Apr. 29) T. M. Dow, G. A. J. Malcolm, A. W. Wood.

The follg. Act. P/Os. on probn. are graded as P/Os. on probn.:—(Sept. 30, 1940) E. M. Saunders (substd. for notifn. of Mar. 28); (Mar. 29) H. E. Todd, E. Evans, D. E. Cottrell, P. N. Davey, T. K. Davies, D. Garrick; (Apr. 4) E. V. Saffery, A. W. Zimmerman, H. A. F. Summers, A. S. Wordsworth; (Apr. 11) R. Ollerhead, F. J. Spokes A. G. Hands, M. G. W. K. Harris, M. V. Coad, C. E. Cruft, F. T. Rainey, A. C. Boevor, N. Clayton, S. E. Barber.

P/O. F. A. Blackmon is promoted to war substve. rank of F/O. (Apr. 1).

The follg. P/Os. are granted war substve. rank of F/O.:—(Aug. 6, 1940) L. N. Reynolds; (Oct. 1, 1940) P. G. Boyd; (Oct. 15, 1940) T. H. Bryant, M.C.; (Dec. 23, 1940) J. R. Butler; (Jan. 8) L. L. Walters; (Feb. 6) J. S. Stevenson; (Mar. 1) J. S. Comper; (Mar. 9) J. C. Murray; (Mar. 22) R. H. S. Lyall; (Mar. 23) A. Swinton-Vaughan.

P/O. on probn. D. D. Legg is transfd. to General Duties Branch (Apr. 16).

The follg. are transfd. to Technical Branch:—F/Os.: (Apr. 24, 1940) F. A. Coleman, G. H. Williams; (Aug. 14, 1940) G. A. Woodwark; (Nov. 24, 1940) C. McC. Henderson. P/O.: (Aug. 20, 1940) A. W. Buck. P/Os. on probn.: (June 22, 1940) D. E. Clarkson; (June 30, 1940) A. W. Harris; (July 25, 1940) C. J. Williams; (Aug. 20, 1940) C. E. Armand; (Aug. 30, 1940) W. P. Gregg; (Sept. 17, 1940) J. Wallis; (Oct. 2, 1940) T. Emmerson, G. C. Jobling, H. J. Knevitt; (Oct. 10, 1940) G. S. Bosworth; (Nov. 24, 1940) H. I. Evans, C. R. Heazlewood, P. G. G. Knight; (Nov 25, 1940) F. G. Battersby, C. J. Boydell, G. Turner-Cain, R. W. Sanderson, J. L. Sloan; (Dec. 1, 1940) O. L. Hyde; (Dec. 6, 1940) F. H. Stowe; (Dec. 21, 1940) W. G. Bradshaw, F. Ellis, S. G. Driver; (Dec. 30, 1940) S. J. W. Ford, R. A. Abbott, I. M. Andrews, J. W. A. Andrews, T. E. Blackall, E. C. Brown, K. H. Donovan; (Jan. 12) B. Hartley, A. D. Knight, P. R. Levy, F. E. Lord, P. Nash, G. C. Wainwright, N. S. Watson, J. M. Wertheim; (Jan. 21) F. J. B. Budgett, W. C. Cockburn-Mercer, T. E. St. J. Killen, C. T. Llewellin-Jenkins, W. H. Clucas; (Jan. 26) C. A. Baker, A. Banister, H. W. Boyett, V. W. G. Day, T. U. Dunn, W. U. Dykes; (Feb. 10) G. W. M. Dunn; (Feb. 17) V. D. Maclachlan; (Feb. 24) W. A. W. Lankshear; (Mar. 2) A. G. Alsop, D. C. Bax, P. J. Beatty, R. O. Bennett, R. E. A. Bratt, C. J. Glover, T. D. Griffin, D. K. James, G. C. Lillicrap, R. A. Lyall, J. S. Welsh, G. B. Weston; (Mar. 8) C. C. St. J. Cramp, H. Robinson, M.M.; (Mar. 26) H. P. Birchenough, J. B. V. Burgis, R. Dewhurst; (Mar. 30) V. J. M. Bosher; (Apr. 12) C. C. H. Adamson.

P/O. on probn. R. S. Engledue resigns his comman. (Apr. 27).

*Training Branch.*

The follg. are granted commns. for duration of hostilities as Act. P/Os. on probn.:—(Feb. 1) A. M. Bailey, A. C. Ball, J. F. Byrom, G. R. Chadwick, H. A. Collinson, C. H. Cottrell, E. B. Crosby, J. B. Elton, R. F. Gill, E. S. Hartley, W. H. Herd, C. H. Hughes, W. C. Johnson, H. M. E. Leyshon, R. D. Muir, A. T. Scott, J. de C. Sizer, F. S. Thomas, W. F. Whiting, T. H. Wood, A. E. Wooldridge; (Feb. 4) J. T. Turner; (Feb. 5) C. Bevers; (Feb. 7) L. Horsfall, F. G. Mee; (Feb. 11) G. M. Hilbourne; (Feb. 12) C. F. L. Read; (Feb. 13) H. Crocker; (Feb. 15) T. P. Gutteridge, J. F. L. Heard; (Feb. 17) P. F. Morton; (Feb 18) S. Andrews, R. Elliott; (Feb. 19) C. C. Copland, F. C. Gould; (Feb. 21) W. W. T. Moore; (Feb. 25) W. Smith; (Feb. 26) A. Bray; (Feb. 28) W. E. Hurley, J. Mattocks; (Mar. 3) H. Chatterton; (Mar. 4) W. Elliott; (Mar. 6) S. F. Clouting, S. A. Fox; (Mar. 7) G. F. Houston, E. Jones, R. H. Matthews, G. J. R. Potter, K. L. Wardle; (Mar. 8) J. W. E. Green, G. T. Lloyd; (Mar. 10) A. Anderson; (Mar. 17) N. F. G. Butcher, H. J. Davis; (Mar. 18) J. A. Jones; (Mar. 22) J. C. Burch; (Mar. 24) R. W. Burkitt; (Mar. 26) C. Blow, G. C. Sculfer; (Mar. 28) G. S. Humphreys, D. L. Venning; (Mar. 30) F. G. G. Armstrong, M. S. Eggleshaw; (Mar. 31) G. E. Camp, A. H. Morris, G. F. Purvis, F. K. West, M. W. Wetherell; (Apr 1) E. B. Cole, C. Hurst, I. H. Kew, G. M. Locks, M.C., D. Norwood; (Apr. 2) H. J. Taylor (Apr. 3) J. McPherson, S. B. Wood; (Apr. 5) J. M. Brown, A. J. Corrie, H. Dale, W. W. Foster, A. E. Garrett, W. J. Gibb, H. Hill, A. F. Honeysett, J. Nimmo, A. W. Overland, C. J. Pool, W. Raylor, W. H. Reynolds, C. H. Slater, G. A. Spooner, C. H. Toy; (Apr. 7) W. Aitken, D. J. Sutherland, W. Ward; (Apr. 8) T. A. Brown, N. H. A. Clark, R. A. Johnson; (Apr. 10) J. C. Blakey; (Apr. 11) A. Cawkwell, H. M. Critchley, C. J. M. Flood, W. M. W. Livingston, C. G. Martin, H. Mason, J. A. V. McDonagh, S. C. Morrish, L. E. M. Price, A. Rawlinson, W. E. Smart, V. L. Stanley, F. Stead, W. Strang, R. Warburton, L. A. W. Webb, H. S. Williams; (Apr. 12) S. D. Wade; (Apr. 13) J. A. Crofton, B. J. F. Dorrington, J. Geals, E. W. Harrison, R. T. High; (Apr. 15) E. Cropper, R. G. L. Jenkinson, J. Stevens, R. Strange; (Apr. 16) R. P. Brumbridge, C. H. Bulcock, C. H. Butler, W. L. Carter, H. B. Collison, A. Cooke, T. Cooper, D. L. Cowe, A. L. Creed, P. Crossland, H. B. Davies, H. A. Donaldson, L. W. Dove, L. S. Deubert, S. Edgar, G. M. Edmondston, A. G. Edwards, P. S. Elder, A. W. Eley, B. T. Ellis, W. Finlay, E. J. Fisher, T. R. Garrigan, A. Gaunt, M. Graham, D. B. Hair, R. A. Hales, N. R. Hamnett, V. Harrison, A. Hartley, R. A. Hayson, J. H. Heaneay, E. T. Hirons, J. Hofton, H. C. Holding, F. B. Hollows, C. T. G. K. Hope, J. C. Hopkins, A. Hunter, C. L. James, J. Kerswell, L. G. Kimmins, W. T. Lack, A. Lambert, A. V. Laws, O. W. Layzell, W. J. Leonard, T. Lewis, A. T. Lindley, K. Lloyd, H. H. F. Miller, L. Page; (Apr. 17) J. H. Chapman, C. L. Collett, W. Coutts, H. F. O. Dawes, E. D. G. Dawkins, H. Downes, M. B. Fells, N. C. Field, A. M. Freeman, C. Gibson, P. F. Glover, E. V. Greenway, A. Hatfield, F. Johnston, W. A. Kitson, F. G. Lewis; (Apr. 18) W. A. J. Chapman, F. Emmerson, J. H. Marland, E. McLean, H. L. Miller, O. S. Moodie, R. E. Nation, K. A. Neale, H. W. Norris, C. W. Pallister, L. E. Pead, R. H. Peters, A. W. Phillips, W. J. Pierce, H. W. Piper, L. C. Pitts, A. C. Platt, G. L. Platts, R. V. Redpath, W. L. Reynolds, G. S. Rhoden, N. Roberts, D.F.C., J. M. Robertson, L. Rollett, H. A. Rolls, G. T. Saunders, R. W. Scott, J. Setchell, T. Sharp, P. W. A. Shearn, E. Shottin, K. H. Simpkin, R. P. Sinclair, H. C. Slim, F. G. Smith, J. Smith, E. D. Soar, A. J. Sparkes, J. Speak, A. B. Turner, C. B. Turner, N. W. Wade, H. Wadge, J. S. Walker; (Apr. 19) J. Berry, H. V. Coopey, G. P. Ford, H. Maynard, S. G. Neal, C. H. Paddock, W. I. Prothero, W. Robson, H. W. Stokes, D. W. Stonebewer, F. B. Taylor, E. L. Thomas, S. Thomas, D. O. N. Ward, E. F. Wilson, P. Wright, C. N. Yeoman; (Apr. 20) T. F. Adams, W. Ashurst, C. H. Ball, G. Beattie, R. W. H. Biss, A. E. Cope, J. M. Faulkner, W. S. Goffe, G. Hughes, G. H. Ingham, H. K. Jeacock, E. J. Jones, L. Kent, G. S. Kirby, J. Love-Smith, R. C. Moore, C. H. Moss, J. H. P. Oxspring, R. L. Smith, S. Vanderhook, A. E. Viccars, J. C. Warboys, T. I. J. Watkins, T. G. F. Wild, T. Wolfenden, J. Wood, G. J. W. Worman, S. Wright; (Apr. 21) K. H. M. Aldridge, P. W. R. Allison, H. C. Beaumont, F. V. M. Bell, M. G. Bircham, D. Boath, J. W. Bowler, A. Braham, C. C. Broadbelt, L. M. Clark, W. A. S. Cormack, F. W. Cowmeadow, E. J. Curtis, G. D. Duguid, A. T. Fowles, J. Goss, J. E. Hackman, W. R. Hall, V. S. Halton, A. H. Harper, A. J. Hills, F. F. B. Hobbs, H. R. Hoggard, A. B. Jones, C. S. W. King, P. E. Lambton, P. A. Leek, N. Lovell, J. G. Nicholas, J. R. Nicklin, H. Parker, R. E. Peterson, S. H. Paton, S. H. Porter, G. J. Reeves, G. Reith, G. H. Roberson, E. L. Rutter, W. A. Sandell, G. H. Spencer, I. W. Stray, A. E. R. Taylor, W. T. Telford, R. B. Tomkins, W. J. H. Varlow, L. C. Walker, T. Ward, H. J. Wood; (Apr. 22) W. H. Patterson; (Apr. 24) W. S. Lewis; (Apr. 28) A. Shand; (Apr. 29) A. E. Elliott.

The notifn. of Apr. 25 concerning A. C. Paterson is cancelled.

*Equipment Branch.*

The follg. are granted commns. for duration of hostilities as Act. P/Os. on probn.:—(Apr. 20) L. V. H. Allemandy, W. S. Allsopp, J. Andrews, J. Aspden, A. C. H. Barchard, G. W. Blow, M. A. Brown, R. F. Chapman, S. N. Chapman, H. P. Collett, F. V. H. Collins, F. S. Cooper, J. E. P. Cowdrey, A. H. M. Creek, H. S. Cullerne-Bown, L. G. Davies, N. O. Davies, R. F. Dennis, J. Dettmer, R. B. Driver, J. Etchells, M. D. Evans, S. S. Everett, A. D. Foster, A. Foyle, A. G. Fraser, C. W. Gains, W. Galloway, R. M. George, W. G. V. Gould, H. J. Grantham, J. Gray, J. C. Griffiths, G. M. Hall, N. S. Hands, E. G. Hannah, C. G. Haskell, M. Hayes, H. G. Holdsworth, F. W. Holmes, E. A. Horsman, J. McA. Hutcheon, J. Jameson, J. T. King, J. J. Latimer, W. G. Lovatt, R. C. Mason, F. Mobbs, F. H. Mooney, J. A. Mowat, F. B. Ostick, J. G. P. Paterson, F. P. Philin, E. F. Reid, K. F. Robinson, R. P. Ross, D. H. Sayer, W. H. Siddle, H. J. A. Stockbridge, A. J. Terry, W. F. Whyman, V. E. Wilde.

P/O. G. B. Thomas is confirmed in his appt. (Nov. 21, 1940) and granted war substve. rank of F/O. (Aug. 27, 1940). (Substd. for notifn. of Mar. 21.)

The follg. P/Os. are granted war substve. rank of F/O.:—(Oct. 21, 1940) P. W. T. Revell; (Mar. 24) R. L. Frith.

The follg. Act. P/Os. on probn. are graded as P/Os. on probn.:—(Feb. 21) W. H. Salmond, J. Fletcher; (Mar. 21) C. W. Forward; (Apr. 18) R. E. F. Barley, W. L. Bundey, R. A. Chalk, J. M. L. Crang, N. A. Doggart, W. E. Douglas-Osborn, V. O. Ganderton, C. C. Hanrott, J. Hinchcliffe, C. V. Howe, H. J. Hubble, K. W. Jemmett, D. R. Lea, A. M. Lotery, A. J. D. Mackintosh, D. Milner, S. O. Osborne, W. E. Rigler, J. C. C. Sim, B. K. Snowden, T. H. Sykes, H. S. Tardrew.

P/O. on probn. G. A. C. Baynes relinquishes his comma. on account of ill-health (May 15).

*Accountant Branch.*

The follg. are granted commns. for duration of hostilities as Act. P/Os. on probn.: (Apr. 20) M. E. Allerton, C. C. Arnold, E. G. W. Couch, W. F. Crundall, T. P. Davies, N. McL. Drysdale, P. W. L. Edgecombe, M. L. Garner, C. Giles, M. R. Harris, J. R. Hayward, H. A. Holderness, R. G. King, E. Kramer, B. A. Law, E. L. Lawrence, D. C. Lazenby, H. M. Learmont, P. D. Macdonald, A. K. J. Mackenzie, W. F. Middleton, W. Miller, J. C. Paterson, G. A. Procter, N. Sacker, L. Scott, C. E. Spencer, L. A. Squair, A. S. Thorpe, H. Tomlinson, N. H. Turnbull, J. Walker.

The follg. Act. P/Os. on probn. are graded as P/Os. on probn.:—(Aug. 6, 1940) H. W. Wilson; (Sept. 3, 1940) T. K. Kane; (Feb. 15) R. E. Bodey; (Mar. 6) C. A. McCaig; (Mar. 29) B. M. Greer; (Apr. 19) L. S. Baker, E. Barnett, F. P. Barnitt, J. Baxter, W. H. Bell, H. G. Bertaut, L. Buchan, T. Collins, M. Damadian, L. R. Edwards, H. Hayes, S. H. Moss, L. H. Stewart, H. H. Wood, A. D. Bodman.

*Medical Branch.*

The follg. are granted commns. for duration of hostilities (Apr. 11) as Flt. Lt.:—H. G. Roberts, M.B., B.Ch., F.R.C.S.(E.), D.R.C.O.G. As F/Os.: H. S. Boyce, M.B., B.Ch. H. Carr, M.B., B.S., F. J. S. Chapman, B.M., B.Ch., P. H. Davies, M.R.C.S., L.R.C.P., L.M.S.S.A., E. H. Gordon, M.B., B.Ch., E. L. Graff, M.B., B.Chir., M.R.C.S., L.R.C.P., D. S. Grant, M.R.C.S., L.R.C.P., R. G. P. Heard, M.B., B.Ch., T. Hepburn, M.B., Ch.B., E. I. Holloway, M.B., B.Ch., L.M., E. K. Jones, M.B., B.S., M.R.C.S., L.R.C.P., D. R. Levinson, M.B., B.S., M.R.C.S., L.R.C.P., J. W. G. McDougall, M.B., B.S., D. A. Osborn, M.B., B.S., M.R.C.S., L.R.C.P., J. M. Russell, M.B., Ch.B., W. Sinclair, M.B., B.Ch., H. J. M. Stratton, M.R.C.S., L.R.C.P., R. D. Tonkin, M.B., B.S., M.R.C.S., L.R.C.P., M. W. L. White, M.R.C.S., L.R.C.P.

The follg. are promoted to war substve. rank of Flt. Lt.:—(Mar. 19) J. Graham, M.R.C.S., L.R.C.P.; (Mar. 26) R. Cuddeford, M.B., Ch.B., G. Oppenheimer, M.B., B.Ch., M.R.C.S., L.R.C.P., H. C. Thomas, M.B., B.S., M.R.C.S., L.R.C.P.; (Apr. 2) M. S. C. Stephens, M.R.C.S., L.R.C.P., (Apr. 16) L. B. Furber, M.R.C.S., L.R.C.P., A. H. Jack, M.R.C.S., L.R.C.P., C. Joseph, M.R.C.S., L.R.C.P., C. B. I. Willey, M.C., B.M., B.Ch., M.R.C.S., L.R.C.P., D. S. Young, M.B., Ch.B.; (Apr. 23) P. M. Davies, M.B., B.S., M.R.C.S., L.R.C.P., D.P.H., A. R. Farmer, M.B., Ch.B., D. R. Gray, M.R.C.S., L.R.C.P., L. M. Magurk, M.R.C.S., L.R.C.P.; (Apr. 30) J. F. Houlihan, M.B., B.Ch., B.A.O., D.P.H.

*Dental Branch.*

The follg. are granted permt. commns. in substve. rank of Flt. Lt.:—(Sept. 14, 1939) Flt. Lt. (temp. Wing Comdr.) H. D. Humphreys, L.D.S., Flt. Lt. (temp. Sqn. Ldr.) S. C. Allen, L.D.S., R.C.S., Flt. Lt. H. Keggin, L.D.S., Flt. Lt. D. I. Malcolmson, L.D.S. Flt. Lt. R. H. Matthews, L.D.S., Flt. Lt. W. E. Nelson, L.D.S., Flt. Lt. W. A. H. Smith, L.D.S., Flt. Lt. H. M. G. Williams, L.D.S.

Flt. Lt. H. D. Humphreys, L.D.S., is promoted to rank of Sqn. Ldr. (July 1, 1940). (Substd. for notifn. of July 30, 1940.)

The notifn. of Jan. 14 concerning Flt. Lt. S. C. Allen, L.D.S., is cancelled.

## *Auxiliary Air Force*

*General Duties Branch.*

F/O. G. E. T. Scrase is promoted to war substve. rank of Flt. Lt. (Apr. 7).

*Equipment Branch.*

F/O. R. C. Crawley relinquishes his comma. on account of ill-health (May 15).

## *Women's Auxiliary Air Force*

The follg. are apptd. Assist. S/Os.:—(April. 30) A/CW.1 K. M. Fitzgerald, A/CW.1 D. V. M. Gray, A/CW.1 P. Harding; (May 3) A/CW.1 S. D. Adams, Cpl. P. I. Barringer, Cpl. W. J. Bishop, Cpl. J. O. Collins, A/CW.1 J. B. Eatough, A/CW.1 B. M. Foster, A/CW.1 C. M. Geddes, A/CW.1 J. Gough, Sgt. F. A. Harland, Cpl. B. M. Hogg, A/CW.2 D. M. Holman, A/CW.1 B. M. Lewis, A/CW.1 B. J. S. McLeod, A/CW.1 E. A. McNeill, A/CW.2 M. K. Mitchell, Cpl. M. Paynter, A/CW.1 P. D. Robins, A/CW.1 H. G. Robinson, A/CW.1 E. M. Stone, Cpl. P. E. J. Ward, A/CW.1 I. G. Waugh, A/CW.1 N. L. Westbury, A/CW.1 R. K. Wise; (May 5) Cpl. R. B. Allcorn, Cpl. E. Armitage, Cpl. M. H. Ballantyne, Sen. Sgt. F. M. Baxter, Cpl. D. P. Black, Sen. Sgt. M. P. Bodger, A/CW.2 R. C. Bull, A/CW.2 M. A. Cooke, A/CW.2 M. A. Cumella, A/CW.1 J. K. H. Cutts, A/CW.1 V. Downs, A/CW.1 E. J. Folkes, Cpl. H. M. Hamilton, A/CW.1 K. M. Hampson, Sgt. D. J. Hellings, A/CW.2 D. J. Hicks, A/CW.1 M. Holliday, Sen. Sgt. R. E. Horstmann, A/CW.1 N. B. Hume, A/CW.2 A. G. Hunter, Cpl. N. Huntley-Walker, A/CW.1 S. F. Ingleby, Sen. Sgt. E. V. Kingham, Cpl. M. J. Lovett, Sgt. C. M. Mitchell, A/CW.2 A. F. Moore, A/CW.2 M. P. O'Beirne-Ryan, A/CW.1 G. E. C. O'Brien, Sen. Sgt. B. Pemberton, Cpl. D. R. Pitts, Sen. Sgt. E. V. Riddle, Sgt. D. P. V. Smith, Cpl. M. Taylor, A/CW.1 M. E. Taylor, A/CW.1 R. M. Taylor, A/CW.2 M. Walder, Cpl. P. M. Wallington, A/CW.1 B. M. Wardle, A/CW.2 A. H. Wilson.

The follg. relinquish their appts.:—(Mar. 8) F/O. M. Coltart; (Mar. 19) Assist. S/O. M. MacB. Hunter; (Apr. 11) Assist. S/O. M. K. Gray, Assist. S/O. P. Millar.

## WAR TIME ENGINEERING TRAINING

A vocational training combining with it the essential practical experience in Aeronautical Engineering required for entrance to the

**FLEET AIR ARM**
*(Maintenance Section)*

**R.A.F.** *(Ground Section)*

**THE AIRCRAFT INDUSTRY**
*(Production and Repairs of Service Aircraft)*

Students accepted from school-leaving age. Specially adapted short courses for men with some engineering experience. Full particulars from the Principal—

**COLLEGE OF AERONAUTICAL ENGINEERING**
**COLLEGE HOUSE, PRINCE'S WAY, WIMBLEDON PARK, LONDON, S.W.19**

## SOUND INSTRUCTION by Postal Method

is offered by the world's largest and greatest correspondence school in Complete Aeronautical Engineering, Aeroplane Designing, Fitting and Rigging, and Aero-Engine Fitting; also expert preparation for Ground Engineers Categories A, B, C and D, and the R.A.S. Exams.

**R.A.F. ENTRANTS FOR PILOTS, OBSERVERS, AIR-GUNNERS**

Special Preparatory Home-Study Courses in Mathematics adapted to individual requirements, for R.A.F. Entrants. In applying to I.C.S. Advisory Department for full information, give details of previous education.

***Write to-day for Free 32-page Booklet "Aeronautical Engineering"***

**INTERNATIONAL CORRESPONDENCE SCHOOLS, LTD.**
**Dept. 182, International Buildings, KINGSWAY, LONDON, W.C.2**
ICS

## *Quick deliveries*

OF CASTINGS FOR

**AIRCRAFT JIGS**

AND FIXTURES. ALSO ALL TYPES OF MEEHANITE CASTINGS. LET OUR REPRESENTATIVE CALL ON YOU. WRITE TO
**WINGET LTD ROCHESTER KENT**

**FOR GROUND "FLYING"**

Scott

**'FLYING SQUIRREL'**
**MOTOR CYCLE**
New Free Folder awaits your application.

**THE SCOTT MOTOR CYCLE CO SHIPLEY, YORKS**


**Rate 3/- per line. Special rates: Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Tenders, 4/- per line. Situations Wanted advts. 3d. per word, minimum 4/-. Press day 1st post Friday. No responsibility can be taken for matters arising from clerical or printers' errors. We retain right to refuse or withdraw copy. Remittances made payable to "FLIGHT" Publishing Co., Ltd. Rates cannot be traced if lost in transit. Box Numbers—the words "Box 000, c/o 'Flight'" must be paid for and 1/- added for registration, etc. Address for correspondence:—"Flight" Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1.**

### AIRCRAFT FOR SALE

W. S. SHACKLETON, Ltd., 175, Piccadilly, London, W.1. Regent 2448. Aeronautical Consulting Engineers and Merchants; the biggest European dealers in and exporters of new and used aeroplanes; C.I.F. quotations to British Empire ports. [3842

### CONSULTANTS AND ENGINEERS

MALCOLM & FARQUHARSON, LTD., Aircraft Agents; associated with R. MALCOLM, Ltd., Aircraft Metal Workers. Enquiries invited.—601, Bath Road, Slough, Bucks. Tel.: Slough 23231.

### CONTRACTS WANTED

PLASTIC Moulders in Acetate, Phenol, Cresol and Urea have presses urgent work, also tool shop.—Box 5660, c/o *Flight*. [3868

### HOTELS AND ACCOMMODATION

HIS MAJESTY'S FORCES Will Be Welcomed During Leave at the Tavistock Club, 37-40, Tavistock Square, W.C.1. Bus. 2775. Special terms. 6/6 room, bath, breakfast. [0156

ROYAL OAK HOTEL, Keswick-on-Derwentwater, heart of English Lake District, offers restful holiday to Air Force Personnel; first-class accommodation at reasonable charges. [3718

### MISCELLANEOUS

£10,000 Waiting for Investment in Used Cars and Motor Cycles.—Coventry Motor Mart, Coventry. [0202

LARGE Stocks Engineers Tools, Vices, Drills, Files etc. Ask for Stock List.—Standard Range & Foundry Co., Ltd., Queen's Road, Watford. [3867

STAFF Time Checking and Job Costing Time Recorders (all makes) for quick cash sale; exceptional condition.—Box 3783, c/o *Flight*. [3040

BULLS New Dunlop, Michelin, Goodyear, etc., also remoulded tyres at great reduction.—Write, stating size, or call at Bulls Rubber Co., Ltd., 173, Shaftesbury Ave., W.C.2. Tem. 1747.

SCALE, aeroplane mascot castings, Spitfire, Wellington, in pairs; brass, 10/6; bronze, 12/6, postage paid; interesting novelty and engine catalogue, 3d.—Butler Novelties, Harrington Rd., Derby.

"WARPLANES."—Photographs and detailed drawings of 23 British and enemy aircraft, with descriptive matter. Price 1/3, from all booksellers or direct from the publishers, post free.—Real Photographs Co., Cooper's Buildings, Church St., Liverpool. [3870

AIRCRAFT PHOTOGRAPHS.—Real photographs of British and enemy aircraft. Send for new list No. 11 (1,250 titles) and specimen photograph post free 4d. Photographs price 3/- per dozen post free.—Real Photographs Co., (F) Cooper's Buildings, Liverpool, 1. [3869

STAFF Identity Passes that Embody the Photograph of Employee, now being supplied to firms on Government and specialised contracts; forgery proof, inexpensive; any size staff; anywhere; distance no object.—Write for particulars and specimens from Miles & Kaye, Ltd., Pass Specialists, 9, Southampton Place, London, W.C.1, or 17, St. Ann's Square, Manchester, 2. Est. over 50 years. [3775

### PATENTS

PATENTS AND DESIGNS ACTS, 1907 TO 1939. NOTICE is hereby given that Aero Survey Corporation, of Box 51, Princeton, New Jersey, United States of America, a Corporation organised under the laws of the State of Delaware, United States of America, seek leave to amend the Specification of Letters Patent No. 530,331 granted to them for an invention entitled "Improvements in contour maps and methods of making same." Particulars of the proposed amendment were set forth in No. 2730 of the Official Journal (Patents), published on May 21st, 1941. Any person, or persons, may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, within one calendar month from the date of publication of the said Journal.—M. F. LINDLEY, Comptroller-General. [3876

### PERSONAL

COURTENAY.—On May 18th, at her home, "Eolka," Carshalton Beeches, Surrey, to Muriel Allpress, wife of William Courtenay—a daughter (Sally). [3875

ADVERTISER with Small Research Works is desirous of getting in touch with someone wishing to develop ideas connected with Aeroplane industry.—Box 5058, c/o *Flight*. [3865


## AERONAUTICAL TRAINING IN WARTIME

***is full of great possibilities to every Student. There is no better Aeronautical Training than that furnished by The T.I.G.B. which has enabled so many men to achieve success in the Aircraft Industry, in the R.A.F. and in the Examination of The Royal Aeronautical Society.***

**Qualify now by home study with The T.I.G.B.**

**T.I.G.B. STUDENTS HAVE GAINED**

## 19 FIRST PLACES

**in The Royal Aeronautical Society's Examination (A.F.R.Ae.S.)**

Write TO-DAY for "The Engineer's Guide to Success"—Free—containing the world's widest choice of engineering and aeronautical courses—over 200—including **Aeronautical Engineering; Aircraft Design; Aeroplane Structure; Aircraft Construction; Aero Engine Design, Construction, Operation and Maintenance; Aerodynamics; Aerial Transport; Aerial Navigation; Meteorology; Aircraft Materials, etc.,** and which alone gives the Regulations for Qualifications such as **A.F.R.Ae.S., Ground Engineer, Air Navigator, A.M.I.Mech.E., A.M.I.E.E., C. & G., etc.** The T.I.G.B. guarantees training until successful.

**ALL INTENDING TO ENTER THE R.A.F.**

As Ground Engineers, Wireless Operators, Navigators, Observers, can study at home with The T.I.G.B. for these technical duties. Details on application.

**THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN**
**37, Temple Bar House, London, E.C.4**

## SHEEPSKIN FLYING BOOTS

Zip front **63/-**
Covered front willow calf **84/-**

## FLYING SUITS

in fine quality serge, finished drill. Zip fastening front, legs and cuffs.

In white, navy or black .. .. .. **38/6**
(Prices include Purchase Tax)

*You can order through the post with every confidence as our stocks are safely stored in various localities to prevent dislocation of business.*

**Write for fully illustrated Catalogue of Goggles, Helmets, and other equipment, post free.**

## D. LEWIS LTD. (Dept. F.)

**124, GT. PORTLAND ST., LONDON, W.1**
*No other London address.*
*Tel.: Museum 4314. Tele.: Aviakit, Wesdo, London*

## LOCATING KEYS

to the specific requirements of our customers.

Bar Repetition Products made specially to Air Ministry Requirements.

**M·C·L AND REPETITION LTD**
**POOL LANE, LANGLEY, BIRMINGHAM**

## STOPS

Makers of all types of repetition products from the bar in all metals.